ENGINEERING NEWS

THE Burlington freight brake tests begun on Monday of this week, the Westinghouse, Eames, Hanscom and Carpenter brakes being on hand with 50 cars each, and the American expected to appear shortly. *All* the above are automatic air brakes, the first, second and fourth having electric appliances to put the brakes on simultaneously throughout the train. The advance within the brief period of ten months since the last tests is very noticeable, and is largely if not wholly due to the fact that those tests were made.

REPORT has it that S. H. BARRETT has practically succeeded in running a dynamo for car-lighting by power obtained from the car-axle and in storing sufficient excess electricity to light the train when standing still. The experimental train has been running for about a month on the Connecticut River R. R. He uses 16 incandescent lights of 16 candle power each in a car. He transmits his power from a 12 in. pulley on an axle at one end of the car through an endless ¼ in. wire cable to a 16 in. pulley, with the dynamo-belt running about a 36 in. pulley. Ingenious devices are used for regulating the speed. The dynamo is 5-horse power, and a Julien storage battery is used with 24 cells, which when fully charged will light 3 cars for 2 hours; an automatic governor cuts the connection between the storage battery and the dynamo when the car stops, so as to prevent the fluid from running back and melting the brushes. Mr. BARRETT estimates $600 as the cost of fitting up 3 cars, and the total weight for same is about 1,000 lbs.

IT is reported with strong probability that the Boston & Providence is likely to be consolidated with the Old Colony or the Boston & Albany, and it would be in every way desirable if it should be so. One of the chief reasons why New England practice has lagged behind that of the rest of the country in the last ten or fifteen years, has been that its system was divided up between such a multitude of little corporations, each so small as not to afford room for a properly qualified staff to cover all the various and diverse duties connected with railway administration. The consolidation of the Boston & Lowell with the Boston & Maine has been another step in the same direction, and the Fitchburg and Hoosac tunnel line is still another. It will be well if the tendency continues. There are only some 6,420 miles in the New England states and its management is divided up between nearly ninety different companies, not including lines leased to others. High efficiency is all but impossible under such circumstances. It would be much better in the end for all interests if four or five managements controlled the whole of it.

THE Railroad Commissioners of Minnesota are addressing some very pertinent questions to the general managers of railroads in that State regarding the inspection of their bridges and trestles. They are to report in 20 days whether or not such inspection is made at stated times or at discretion; the name and title of official inspectors; how often such structures are inspected, and the date of the last inspection.

THE projected railway tunnel under the Simplon Pass of the Alps has been very lately assuming some definite shape, and $1,000,000 has been voted by the National Council of Berne towards this purpose. The tunnel will be 10 miles long, but the approaches are very easy as compared with other Alpine tunnels, and the elevation is 1,000 ft. less than the St. Gothard. All told, the sum of $2,300,000 has been secured for the project, and some of its promoters believe that it can be commenced before the end of 1887.

THE introduction of the high-duty attachment to the Worthington pump, which about doubles the duty of this well-known engine, has been watched with much interest by pump-users throughout the country. Until very recently the New Bedford engines were the only ones of this type in actual use; but others now are being practically tested. The City of Montreal having had Worthington pumps in use for about 12 years has recently added a 10,000,000 engine of the improved type, and while no official duty-test has yet been made we have the testimony of the Chairman of the Water Committee that the engine has made continuous runs of 12 and 15 days and nights without heating or trouble, and that, as compared with the old form of engine, a saving of $50 per day in fuel was assured; this is a very practical test of duty after all. In addition to the Montreal engine another of the high-duty engines, of 2,000,000 galls. capacity, has been sold to the Cedar Rapids Water Company, Iowa, and eight more of this improved type are under construction at the Works of Simpson & Co., of London, and one has recently been started at West Surrey in England.

THE Grant Locomotive Works of Paterson recently shipped through Messrs. Russel & Co. of China the first locomotive engine ever built in America for use in China. It goes to the Kaiping Railway Company, limited, which controls the Kaiping coal mines, about seventy-five miles northeast of Tien-tsin, in the province of Chihli, and has a light railroad of standard gauge, twenty-eight miles long, and used for hauling coal.

Bradstreets' as the result of a special inquiry, notes the marked increase of the Bessemer pig output as compared with other pig-iron production. Out of about 350 furnaces now in blast, 100 are at work on Bessemer pig, producing about 60,000 tons weekly out of a total output of 137,000 tons of pig-iron, or about 43 per cent. This Bessemer percentage is just the same as one year ago though the aggregate production has increased 32 per cent. This means ultimate independence of foreign Bessemer iron and foreign ores.

RICARDO ORZOCO, "an eminent engineer," proposes to improve the sanitary condition of the City of Mexico by furnishing a complete system of what he calls "a continuous desinfecting circulation by mechanical and chemical means." He does not disclose the detail of this system but offers to put up a forfeit of $30,000 to guarantee its success; he says he can complete the necessary work in six months, with the water under the city kept permanently one metre below the surface of Lake Texcal. He gives no estimate of cost.

AN article in the English *Iron and Coal Trades Review* strongly condemns the almost universal English double-headed rail, as compared with the flanged rail. The writer puts the case clearly; shows that the difficulty of rolling which once made the double-head the easier to produce, no longer exists; the idea of reversal of head is exploded because when the top is worn out the general section is much reduced and the bottom head indented by the chairs; that the flanged section presents the greatest strength for the same weight and a flanged rail would do away with chairs altogether. The writer finally concludes that as these facts are all well known to the leading railway engineers of England, the only reason why that country remains behind the world in rail-section is that the engineers are unable or unwilling to act upon their convictions, and fear that two rail sections would cause confusion on the lines. The certain other element of British tenacity in holding on to established British custom, as the best under all circumstances, is not touched upon.

THE construction of the Holstein Canal, intended to connect the North Sea and the Baltic, will be officially commenced on June 18 next at Holtenau. The St. Petersburg sea-canal, opened in 1884, has increased the exports of St. Petersburg from 280,000 tons in 1883 to 950,000 in 1886; but the aggregate tonnage of the this port and Cronstadt has decreased in the same time some 700,000 tons, with the tendency of Russian boats to abandon the Baltic and seek new outlets through the Black Sea. The commerce of Cronstadt is almost totally destroyed.

AN East Indian exchange gravely tells us that "An American company is about to tunnel the Rocky Mountains and thus at last open railway communication between the Atlantic and Pacific slopes." How about the six trunk lines now crossing these same mountains.

THE Brooklyn Bridge is severely taxed, as to its carrying capacity, during the busy hours of the day and the Trustees are considering means of increasing the traffic facilities. CHARLES E. EMERY, M. Am. Soc. C. E., has made a report dealing with the subject under three heads: (1) Doubling the capacity by providing for trains of six instead of three cars, (2) The addition of a second cable to dispense with shifting locomotives at the termini, (3) A cable system for the roadway. The first plan is recommended to be carried out first; outgoing passengers would be discharged at a central platform and incoming passengers would enter from side platforms as at present, trains leaving alternately from each side of the central platform. A further extension of the structure in Brooklyn is contemplated, and alterations at the New York end. Several new cars have been ordered. Improvements in the approaches to the trains are to be carried out. The total number of passengers in April was 2,652,159, of which number 2,379,360 took the cars and 272,799 the promenade. The total traffic receipts for April were $72,665.07.

THE recent earthquake in Arizona seems to have covered an area of nearly 1200 miles by 600. The average duration of the wave was 1¾ min. in the direction from S. W. to N. E. A railroad track at one place was thrown 4½ in. out of line toward the south, for a distance of 300 ft. One crack in the earth, 8 to 18-in. wide, extended for 25 miles.

THE floods still continue in New England. One highway bridge has been wrecked and the abutments of several railroad bridges on the Maine Central Railroad have been undermined. Indiantown and Fredericton, N. B., have been flooded. The water-works at Bangor have been damaged, and it will be at least two weeks before they can supply the demand. In Pennsylvania a serious washout occurred on the Ligonier Valley Railroad. Landslides have occurred at Cliff Cave, Mo., on the St. Louis, Iron Mountain & Southern Railroad, at Miller's Falls, Mass., on the Fitchburg Railroa and near Pointed Rock, Mont., on the Northern Pacific R. R.

THE last *Bulletin du Canal de Corinthe* says that the work of excavation is being pushed at an average rate of 9,000 cu. yds. per working day. The report apologizes for any seeming delay by stating that it is rather tough work to dig a trench 288 ft. deep and about 14,000 ft. long through solid rock; a remark which no one will deny. On Feb. 15 the accidental explosion of about 4,000 lbs. of powder on the works killed 7 men and wounded 4 others. The workmen were about to load the powder on a train when the accident occurred. Several serious slides have taken place from the sides of the cut owing to lack of sufficient slope, and these justify the late orders to greatly flatten these slopes; the original inclination was 1 in 10.

THE "American Exhibition" has opened in London with great éclat, the éclat coming for the most part, however, from BUFFALO BILL'S show. The Queen and Royal Family have given the last touch that was necessary to insure its great success, by their patronage. A great secret of its success, in addition to its other merits, seems to be that it satisfies a natural curiosity as "a faithful picture of American life." We who have been familiar from childhood with such scenes as the show depicts, can hardly appreciate the interest with which Indian attacks, and quadrilles danced on horse-back, and that sort of thing are witnessed in London. Of course such things are not so common along the coast settlements, you know, but as you go out west to Buffalo and Utah, and thereabouts, they are quite the regular thing.

LIGHTING the Hoosac Tunnel has for years been a problem much talked about but never tried. The Fitchburg road is now going to make a practical test of it, and this week a dynamo has been placed in the old air compressor building at the east end of the tunnel. Wires will be run the entire length of the tunnel, powerful lamps suspended from the roof, and nothing but the test will explain whether the scheme can be successfully carried out. The plan, if successful, will be a great boon to the freight brakemen.

The New Method of Dimensioning.

BY ALFRED D. OTTEWELL, C. E.

I.

For many years past engineers have uniformly adopted the so-called factors of safety, because it covered a multitude of sins and because it saved their structures, and consequently their good reputation, from destruction. During the past six or eight years, however, this "factor of safety" has been dubbed the "factor of ignorance" and consequently engineers have become chary of using it. This change of title seemed to be justifiable when the fact was recalled that the experience of engineers had necessitated the practice of making structures from 200 per cent. to 900 per cent. stronger than calculation called for; which simply showed that what they could not estimate, what they did not know, amounted to from two to nine times what they did know and what they could estimate. Hence the term "factor of ignorance" seemed quite as legitimate as the term "factor of safety," but it was not as desirable an associate. For this reason, other means than that afforded by the factor of safety, or factor of ignorance, have been sought by which equal, if not greater, security could be obtained. This search has brought to light the fact that we should consider separately the effect of live and dead loads, and that we have been wrong in assuming the ultimate, or temporary strength, as permanent strength; but rather that we should look for permanent strength where permanent *set* begins.

With regard to the effect of dead and live loads we have known for many years that a live load was more injurious to a structure than a dead load, but so long as we added the strain due to live load to the strain due to dead load and multiplied by any factor of safety our fancy might select, we stood little chance of producing an economical bridge, and gave plenty of chances for hair-splitting firms to fatten on the good of the land.

For the purpose of distinguishing the effect of live load from the effect of dead load a number of formulæ have been proposed for adoption. Most of these formulæ are modified forms of the following formulæ of LAUNHARDT and WEYRAUCH.

LAUNHARDT'S formula is for pieces subject to one kind of stress only (tension or compression) and takes the form:

$$a = u\left(1 + \frac{t-u}{u}\,\frac{min.\ B}{max.\ B}\right) \qquad (1).$$

WEYRAUCH'S formula is for pieces subject to stress acting in opposite directions, and takes the form:

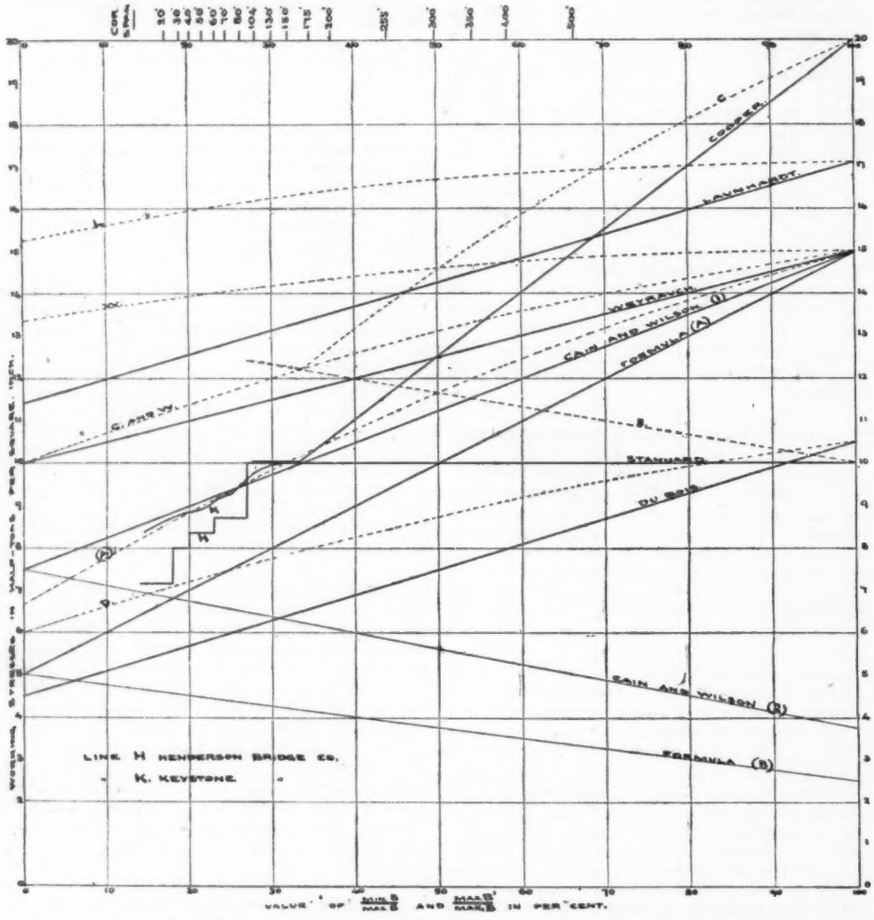


Diagram showing the effect of Various Formulae to Reduce the Working Strain per Square Inch as the Range of Strains becomes Greater.

[NOTE: Since writing the present article the writer has been informed that the Keystone Bridge Company in its new specification (1887) has adopted the new method of dimensioning.]

$$a = u\left(1 - \frac{u-s}{u}\,\frac{max.\ B}{max.\ B}\right) \qquad (2).$$

For spans over 150 ft., Mr. THEODORE COOPER adopts a formula which reduces to the following modified form of LAUNHARDT'S formula:

$$a = u\left(1 + 3\,\frac{D}{max.\ B}\right)$$

For reasons to be explained further on, the writer would propose for railroad bridges the following modified form of LAUNHARDT'S formula:

$$a = u\left(1 + 2\,\frac{min.\ B}{max.\ B}\right) \qquad (A).$$

and for the formula of WEYRAUCH the following modified form.

$$a = u\left(1 - \frac{max.\ B}{2\ max.\ B}\right) \qquad (B).$$

where, in these various formulae,

a = safe working strength per unit of section under assumed condition of loading.

u = safe strength per unit of section for any number of repetitions of load.

t = safe strength per unit of section for a single static load.

s = safe vibrating strength per unit of section when the opposite stresses are equal.

$max.\ B$ = the greatest stress upon the member, whether of tension or compression.

$min.\ B$ = the least stress of the same kind.

$max.\ B'$ = the greatest stress in the opposite sense.

D = the stress, of the same kind as $max.\ B$, due to dead load.

The following are the values, in pounds, for wrought-iron railroad bridges, of u and t for a unit of 1 sq. in., proposed by the authorities named:

The values of $\frac{t-u}{u}$ are also given.

	Launhardt.	Weyrauch.	Cain & Wilson.	Du Bois.	Cooper.	Formula A.
u	11,430	10,000	7,500	4,500	5,000	5,000
t	17,130	15,000	15,000	10,500	20,000	15,000
$\frac{t-u}{u}$	$\frac{1}{2}$	$\frac{1}{2}$	1	$\frac{4}{3}$	3	2

The value of u (5,000 lbs.) given for formula (A) is for double rolled iron in tension (links or rods).

For rolled iron in tension or compression (plates or shapes) I would propose

$$u = 4{,}500, \qquad t = 13{,}500.$$

The unit stresses for members in compression to be further reduced from the above values of a by one of the many column formulæ.

The limiting values of a in formulæ (A) and (B) are for iron of standard quality, as, for example, iron of the following specification:

"All wrought-iron must be tough, fibrous, uniform in quality throughout, free from flaws, blisters and injurious cracks, and must have a workmanlike finish. It must be capable of sustaining an ultimate stress of 46,000 lbs. per sq. in. on a full section of test piece, with an elastic limit of 23,000 lbs. per sq. in."

"All iron to be used in the tensile members of open trusses, laterals, pins, bolts, etc., must be able to sustain an ultimate stress of 50,000 lbs. per sq. in. on a full section of test-piece, with an elastic limit of 25,000 lbs. per sq. in. and a minimum stretch of twenty per cent. measured after breaking in length of eight inches."*

The "permanent strengths" from the above specification being 25,000 lbs. and 23,000 lbs. per sq. in. we have for the proposed limits of 15,000 lbs. and 13,500 lbs. respectively, a margin of about 10,000 lbs. or about 40 per cent., of original section, to allow for (1) deterioration by rust, (2) flaws and inequalities of material, and (3) imperfect design and workmanship. If this margin be considered high it should be remembered that with the present state of good material and workmanship, items (2) and (3) are small, probably not amounting together to more than 10 per cent. whilst the life of the structure is proportional to the margin allowed for deterioration by rust; so that it is an economical margin.

For the lower limit, 5,000 lbs., we have not only the above three causes to reduce the "permanent strength" from 25,000 lbs. to 15,000 lbs. but also a still further reduction to allow for sudden loading and impact. If the load were quiescent it has been shown that 15,000 lbs. would be safe, but if the load smoothly and suddenly slide on the bridge we know from mechanics that 7,500 lbs. would be as injurious as the previous 15,000 lbs., and if the load does not roll over smoothly, but produces blows from unbalanced wheels, from connecting rods, etc., as is the case in railroad bridges then it is safe to assume that 5,000 lbs. would only be as safe as the 7,500 lbs. or 15,000 lbs. Thus allowing 33⅓ per cent. for impact. For the lower limit, 4,500 lbs. the same argument will hold.

Over and above this reason, however, is the fact that the men who have been brought face to face with iron under impact and practically all live load, viz: mechanical engineers, consider 4,000 lbs. to 5,000 lbs. *the safe working stress for such cases.* We should naturally expect mechanical engineers (who deal principally with dynamical loads) to be best able to fix the 4,500 lbs. and 5,000 lbs. limits; and that civil engineers (who have hitherto paid more attention to

* Mr. JOSEPH M. WILSON'S specification for bridges for the Pennsylvania Railroad Company.

static loads) to be best able to fix the 13,500 lbs. and 15,000 lbs. limits.

On the attached diagram is shown graphically by the full lines the limiting and intermediate values of the safe working stresses for wrought-iron railroad bridge members according to the authorities before mentioned. The full lines marked *H*, *K* and "standard" give the unit strains required by the usual or "standard" specifications of 10,000 lbs. per sq. in. for spans over 80 ft., and adding a percentage for spans under 80 ft.

The column marked "Cor. Span" at the top of the diagram gives the approximate spans in which the stresses due to dead load would be to the stresses due to dead and live load as the given value of $\frac{min.\ B.}{max.\ B.}$, the live load consisting, in this case, of two "Typical" consolidation engines, followed by a train weighing 3,000 lbs. per foot of track. This column has been obtained from a series of actual weights of single track through bridges given in a valuable paper read by Mr. GEORGE H. PEGRAM before the American Society of Civil Engineers.

Up to a year or two ago, great uniformity existed in the practice of bridge builders with regard to unit stresses for railroad bridges; the lines marked *H*, *K* and "standard" in the diagram representing very fairly those unit stresses. But since the adoption of this new method of dimensioning by our leading engineers there has probably been a greater want of uniformity in engineering practice in this respect than ever existed before. For example, if a truss of 500 ft. span, say, has simply a dead weight to carry one leading engineer will strain the iron in the bottom chord to 20,000 lbs. per sq. in., others to 10,000 lbs., the majority straining the same iron to 15,000 lbs. (formula *A* gives 15,000 lbs.), whilst before the adoption of this new method of dimensioning the uniform practice was about 15,000 lbs. If the truss is subjected also to a rolling load one engineer will strain the iron in the bottom chord to 15,000 lbs. per sq. in., others to 13,500 lbs., others lower than 9,000 lbs., the majority straining the same iron to 10,000 lbs. (formula *A* gives 11,670 lbs.), whilst before the adoption of this new method of dimensioning the uniform practice was about 10,000 lbs.

It will be noticed that all the formulæ, with the exception of the one proposed by Prof. DU BOIS and formula (*A*), allow a greater unit stress in the main members of a truss than has previously been considered good practice. Whilst the superior distribution of strength to strain obtained by all these formulæ over the former method of dimensioning may be admitted, there is grave doubt as to whether we have sufficient authority to make bridges lighter on the whole, than we have been in the habit of making them, even in cases where an increase of load is improbable.

An increase of loading on most of our bridges is, however, probable, so that if to-day a bridge be designed to carry a rolling load of 3,000 lbs. per ft. according to any of these formulæ, the question arises, what will be the unit stresses in this bridge when the rolling load increases to 4,000 lbs. per ft.? This question is answered by the dotted lines of the diagram.

Looking at this diagram the question arises, how will the bridge designed to formula (*A*) compare with one designed to the "standard" specification when the rolling load has increased from 3,000 lbs. to 4,000 lbs. per ft. For spans up to 300 ft. the former will be the stronger, but for spans above 300 ft., it is lighter and may possibly be in some cases weaker. If, however, in these cases, this additional strength is necessary (and if it is, why not for the shorter spans?) it can be secured with much less weight by formula (*A*).

It will be seen from the diagram that the bridge designed to formula (*A*) is practically as strong when the rolling load has increased from 3,000 lbs. to 4,000 lbs. per ft. as a bridge designed by Messrs. CAIN and WILSON'S formula is when it is first built.

It will be noticed from the diagram that formula (*A*) involves the greatest change from usual practice in the smaller spans. But even in the 130 ft. span we only require an additional weight of 27.4 per cent. from that required by standard specification, which means an additional cost of about 9 per cent. But our bridge designed for a rolling load of 3,000 lbs. per ft. is stronger when the load reaches 4,000 lbs. per ft. than the other is when first built so that if it takes 9 years to change from a rolling load of 3,000 lbs. to 4,000 lbs. our bridge will have cost us during those 9 years one per cent. per annum.

Formulæ (*A*) and (*B*) are proposed for railroad bridges. For highway bridges, whilst the upper limit, 15,000 lbs. should remain the same, for the lower limit 7,500 lbs. would be better, since the live load is much less suddenly applied, and there is little impact. For highway bridges it would be better therefore to adopt the formulæ of Messrs. CAIN and WILSON, viz:

For pieces subject to one kind of stress only (tension or compression),

$$a = u\left(1 + \frac{min.\ B}{max.\ B}\right) \qquad (C).$$

For pieces subject to stresses acting in opposite directions,

$$a = u\left(1 - \frac{max.\ B}{2\ max.\ B}\right) \qquad (D).$$

where u = 7,500 lbs. for double rolled iron in tension (links or rods); or 7,000 lbs. for rolled iron in tension or compression (plates or shapes.)

Precautions Against Fire.

The following instructions have been recently issued by the Associated Factory Mutual Insurance Cos., to their inspectors and to the managers of property insured by them, and is an excellent illustration of that care which has resulted in so great a decrease of the fire risk. We abbreviate slightly:

Hydrants.—As the weather is now, or soon will be, warm enough to avoid all danger of freezing, hydrants should be carefully examined to see whether they have been cracked during the winter by freezing, and whether they are in good order or not. The past winter has been a severe one, and some pipes have been already found broken and some hydrants cracked, since our spring inspections began.

Sprinklers:—Attention should be called to all dry-pipe systems of automatic sprinklers, and to sprinklers from which the water has been shut off during the winter, in order that water may now be let on in a suitable manner, and that all the apparatus may be in good condition to meet emergencies.

Flushing Sprinkler Pipes:—In two or three instances mill managers have thought it to be expedient to have a valve at the end of the automatic sprinkler service to be opened occasionally; or in some other way to draw the water from the automatic sprinkler service, in order to see if the pipes were clear or not. This is not judicious. It might lead to clogging the pipes with iron-rust rather than to clear them. There is a slight amount of oxygen in the water which is first let into the pipes. This is doubtless converted into rust, and then if the water be allowed to stay without change, it may be assumed that no further oxidation will take place; but, if the water is frequently changed, especially in the small pipes, a sufficient amount of oxidation might take place to clog the sprinklers in the heads.

A sufficient number of examinations have been made as to the condition of the water and of the pipes, after several years of readiness for service, to give assurance that no such trial as that of flushing the pipes is called for. After the water is let on it had better stay undisturbed until examined by an expert, if such an examination becomes desirable.

Sprinkler Valves:—Perforated-pipe sprinklers, which had been put in before the automatic system became generally adopted, are still relied upon for protection in a considerable number of our risks, although many members either have or soon will remove the perforated pipe systems from the more hazardous parts of their property, substituting automatic sprinklers for them, and placing the perforated pipes over weaving-rooms or other departments where they may be of great service. Therefore, so long as the perforated-pipe sprinklers are depended upon, the closest attention should be given to placing the valves where they will not be rendered inaccessible, or become heated during a fire.

The valves to the perforated-pipe sprinklers in the Indian Orchard Mill, Number 2, had been placed in the basement of the tower, close to a large window near the ground, and were assumed to be in the best possible position. The very sudden expansion of heat in the carding-room, which was in this basement, forced the door open between the carding-room and the basement of the tower, and although a prompt watchman was on the spot as soon as the fire was discovered, and probably within a very few minutes after it broke out, the heat had already made it impossible for him to turn the valves after he had broken the window and had reached them. Attention is therefore called to the expediency of placing some outside apparatus to connect with inside valves, and to protect the doorways between the operating department of the mill and the tower wherein valves may be placed, with adequate fire doors fastened with strong fastenings during the night.

Pumps:—When a fire-pump is tried it should be tested to its full capacity. It has been a general custom to try a small or medium size pump with one stream, and a large pump with two streams, for a few minutes only; but owing to the rapid deterioration which a rotary pump may undergo if not well cared for, causing an excessive slip, the pump may when at full speed deliver but a fraction of its normal quantity. A partial trial is therefore, not a good test of the efficiency of the pump, and will not warrant the statement that it is "in good order." The only way to see how good the order is, is to see how much water it will throw.

In two recent cases one of our inspectors has passed a rotary pump on the regular inspection as being "in good order," but on a special inspection when these pumps were tested to their full capacity one could throw only 150 galls. per min. at 85 lbs. pressure, although the catalogue capacity was twice and one-third this quantity: in the second case the pump would actually throw but 236 galls. when according to the standard of its capacity it should have delivered 953 galls; in another case a pair of pumps which had been passed as "in good order," on a partial trial, were capable of throwing only one-sixth their normal capacity; therefore although superintendents may object to wetting a sufficient number of pieces of hose in order to test the pumps at their full capacity, yet as a complete trial comes but once a year it should be required.

Attention may also be called to the deceptive appearance of large pump capacity given by the use of small nozzles, and to the fact that a ring nozzle on account of the resistance caused by the contraction at the sharp corner of the ring will deliver only as much water as a smooth nozzle with an orifice ¼ in. less in diameter. In numerous cases mills which have ample pump capacity have for use on their yard hydrants small nozzles ⅞ in. ring. They should be informed of the advantage of smooth nozzles 1¼ in. diameter, and urged to substitute them for what they now have.

Very few mill pumps are fitted with pressure gauges. A good gauge costs but $4 to $7, and might be of great service in managing the pump in case of fire, as well as in aiding the inspectors in judging the performance of the pump. By observing the pressure gauge during a fire, the bursting of hose or other injury to apparatus might often be avoided. It would be well that every fire-pump be fitted with such a gauge. Attention might well be called to this matter.

It is not intended to do away with the trials of pumps and pipes under the supervision of the regular quarterly inspectors of the mutual companies; but as their inspection could not be completed until the end of the summer, it might be judicious for each manager to make a special trial and inspection at once on his own behalf in connection with the regular drill of the fire department of the mill, without waiting for the inspector to call for it.

Fire in Clothes Closets.—During the last two or three years more than one fire has occurred in the closets in which workmen hang their outside coats, with their pipes still burning in the coat pockets. It is therefore suggested, that, wherever there is already a system of automatic sprinklers, one or more heads should be put into the clothes closets to protect the mills against this accident, especially if any clothing is left over night.

What to do After a Fire.—These instructions never having been received by several members of the mutual system, who have joined since they were first issued, are now repeated.

FIRST. Take prompt measures, without waiting for the presence of the underwriters or their agents, to clean machinery and prevent rust, to sort stock and save it from damage by mildew or by heating, to protect buildings partly burned from exposure to further damage from the weather. In other words, take the same measures to save further damage as would be taken if there were no insurance upon the property.

SECOND. Notify the underwriters to send some one to the premises to assist the manager or owner in ascertaining the exact amount of loss.

It will be observed that damage to property by fire and water does not cause a surrender of property to the underwriter, or impose any duties upon them for its further protection, except so far as they may choose to advise. If damage is caused to property by negligence on the part of the assured, or by their not using due care and diligence in saving and protecting it after fire occurs, such additional loss falls upon the assured and not upon the underwriters.

The contract which the underwriters enter into with the assured to indemnify them for loss by fire is in the following words, taken from the Massachusetts standard form of policy now issued by this and other companies:—

"Said property is insured * * * against all loss or damage by fire * * * the amount of said loss to be estimated according to the actual value of the insured

property at the time when such loss or damage happens * * * *."

"It is moreover understood that there can be no abandonment of the property insured to the Company."

The property injured therefore remains the property of the assured after the fire as fully as before, and is subject to the same care.

Fire Departments:—It is considered to be incumbent upon every member of every Mutual Company to organize a fire department. Where this duty is not attended to, a difference is made either in the rate or the amount of insurance taken, and when long neglected the risks may be dropped.

There seems to be a difference between men as to what constitutes a fire organization; the following statement has therefore been prepared by the Chief of the Bureau of Inspections:—

Many agents take exception to reports on inspectors cards, who mark a mill as having *none*, when they themselves believe that they have an organization and a good one.

If an inspector finds in any mill-yard a sufficient body of men to handle the mill apparatus, who are enrolled as a company, who have their officers, and where officers and men are drilled in their duties, and are perfectly familiar with the same, who have regular meetings for practise in the use of the apparatus, and who are recognized and encouraged by the owner or the agent to make themselves expert in the duties of firemen, whether paid or not, he shall report the organization as *excellent*.

If he find a fire department in a yard whose members perhaps lack an enrollment and written regulations, but who have their regular and recognized leader or chief, and who, though lacking the written regulations, understand that they have a distinct place in the fire department and a regular duty to perform, and who hold themselves ready to perform that duty by day or by night, by repairing at once to the scene of a fire, there to obey orders and do all they can to subdue the fire, then I would have the inspectors record that organization as *good*.

If he find at any mill that there is no enrolled fire company, no regular drill except an occasional Saturday drill in summer, but that all the men in the yard recognize the Superintendent or Master Mechanic as the chief, and are ready to go at once to the fire, and to bring into service all the fire apparatus as quickly and intelligently as they can, then I would have the inspector record the organization as *fair*.

Anything less than the last one I would not recognize at all, but record it as *none*.

This circular will be placed in the hands of all the inspectors, and is now sent to all the members of the Mutual Companies in advance of the spring or summer inspection of their pump and hydrants service. It is suggested to the mill managers that, if they make a spring inspection of all their pumps and hydrants under their own special supervision, they may keep notes of the condition in which they find their apparatus, for the use of the inspectors when they next visit the mill, especially if the pump fails to deliver the quantity of water called for on the catalogue of the makers. Attention is especially called to the suggestion for fitting each fire-pump with a pressure gauge.

If such care as this were more generally imitated in all classes of works it would far more than pay for the trouble and expense.

Sand Washing Machinery.

BY M. HARLE, *Eng. Ponts et Chaussees.*
(Translated by H. N. OGDEN.)

The work on the summit-level reservoir of the canal at Haute-Saone included about 300,000 cu. yds. of masonry, requiring about 104,000 cu. yds. of sand. To secure this amount of sand the contractor opened a pit about 6¼ miles away in the valley of a torrent descending from the Vosges.

The sand there was found mixed with about equal volumes of gravel and with variable amounts of clay which latter in places formed pockets. The material was so compact as to require loosening by manual labor before it could be dug with an excavator. In an attempt to get rid of the clay the pit was first deluged with water to wash this out; but the excavator still carried clay to the cylindrical sifter used to separate the sand and gravel, and this clay in the form of balls found its way into the sand in the wagons being loaded.

A clay washing machine became necessary and to avoid complication of parts this was located between the excavator and the gravel sifter. The arrangement about to be described was suggested to the contractor by the author of this paper, and the problem was satisfactorily solved.

The basis of the machine was a hollowed Archimedean screw, with a portion of the helix still adhering to its sides, but with the width of this spiral gradually diminishing from bottom to top of the apparatus. As this machine was to be utilized as an elevator, the effect of this inequality in height of spiral would be, that while the sand, etc., would be carried up the incline, the volume of water taken up by the lower spiral would be too great for the carrying capacity of the 2nd. spiral, and the 2nd too great for the 3d, etc.; consequently the water would be reduced in volume by the successive revolutions and the excess would flow towards the lower point, carrying with it the clay washed from the sand.

In the apparatus as used the hollowed screw was revolved upon a horizontal axis, and the water admitted at the small, or upper end of the cone and the sand to be washed fed in at the bottom, or large end of the cone; the clean sand was discharged at the top of the incline.

The actual machine was 6½ ft. in length, measured on its axis, and 4 ft. in diameter at the larger end; the driving engine was 15 horse-power, but was also used for the excavating machinery. In a day of twelve hours, this machine readily handled 260 cu. yds. of material in the rough and produced 130 cu. yds. of clean sand. In the working season of 1885 it furnished an aggregate of 22,100 cu. yds. of clean material.

Slate Roofing.—J. L. Creswell, of Toledo, O., contractor for slate roofing and galvanized cornice work, has contracts on the capitol buildings at Atlanta, Ga., and Cheyenne, Wyo., for $30,000 and $25,000.

Tests of Friction of Hydraulic Cupped-Leather Packing made at St. Louis.*

BY THEODORE COOPER, M. AM. SOC. C. E.

The accompanying tests were made at St. Louis in the early stages of the construction of the St. Louis Bridge, to determine the friction of the packing in the hydraulic testing machine to be used for testing the materials of construction. The apparatus was devised by, and the tests made under the supervision of HENRY FLAD, Past President Am. Soc. C. E.

The plate shows the details of the apparatus for making the tests. The casting representing the cylinder contains two leather packings. These were varied in size, as shown upon the drawing, from 1⅝ in. to ⅛ in. in width. The friction was measured by actual weights imposed. The pressure (hydraulic) was obtained by a hand pump, and was measured by means of a mercurial column 46 ft.

Tests on Friction of Hydraulic Cupped Leather Packing, made at St. Louis.

Size of Ram.	9-inch Ram.																		6-inch Ram.																	
Size of Packing.	1⅝ inches.			1⅜ inches.			⅞ inch.		½ inch.		⅛ inch.			Percentage for one Packing.				1⅝ inches.			1⅜ inches.			⅞ inch.			½ inch.			⅛ inch.			Percentage for one Packing.		
	Weight *W* to move Ram.																	Weight *W* to move Ram.																	
Gauge. Feet.	Pressure.* lbs. per square inch.	Total pressure on area of ram.	*W* =			*W* =			*W* =		*W* =		*W* =			Max.	Aver.	Min.	Total pressure on area of ram.	*W* =			*W* =			*W* =			*W* =			*W* =			Max.	Aver.	Min.
0	0	0	26	26	...	100	95	89	139	109	76	34	39	36	34	34	29	34	...	...	...	...	...	25	10	10	10	10	10	10	10	10	10	10	9	9	9	...	...	...
5	11.67	775	56	49	...	123	105	103	159	116	80	39	43	38	40	39	44	39	9.+	4½	2.	553	31	20	20	21	40	25	48	44	43	20	23	23	20	20	20	...	16	13	13	7.8	6.65	2.25
6	13.76	1 070	64	70	62	191	160	130	140	128	93	50	60	60	60	60	58	60	4.5	3.7	1.9	671	55	30	29	27	60	35	60	59	59	30	30	34	27	...	24	21	20	4.23	3.09	1.64
6	16.61	1 385	110	99	70	144	130	130	160	130	93	73	97	89	70	92	76	76	6.25	5.0	4.4	1 037	71	39	36	36	70	70	80	77	70	47	50	50	47	50	45	...	46	39	36	5.97	5.09	1.09
6	17.46	1 455	115	110	90	164	134	106	164	140	80	73	97	90	100	90	90	90	5.7	4.85	1.4	1 220	91	63	64	61	90	90	90	90	74	67	60	60	60	60	61	...	57	53	44	6.32	5.10	1.44
10	29.20	2 775	130	120	100	180	147	140	170	150	94	104	110	100	90	134	100	107	9.4	8.04	1.56	1 697	91	69	61	47	93	91	98	90	91	67	67	67	64	60	57	...	64	49	51	8.91	7.93	1.38
12	71.20	6 880	170	160	119	185	160	140	180	170	104	110	133	133	120	146	116	123	9.9	8.85	1.15	2 005	105	95	80	69	101	91	104	100	85	67	63	63	70	67	63	...	73	67	67	8.61	7.79	1.33
14	59.09	8 385	194	160	131	190	160	135	200	155	110	120	137	123	120	146	120	121	8.9	7.49	1.1	2 260	93	83	66	69	110	98	116	107	100	73	68	63	70	63	70	...	78	63	63	9.47	8.39	0.59
16	54.05	8 060	170	153	130	160	150	130	200	194	127	120	143	136	131	150	143	147	7.7	7.39	1.06	2 655	71	71	60	60	110	105	124	113	100	60	61	60	70	71	70	...	83	60	60	9.51	8.80	0.70
18	102.60	8 765	174	160	150	210	160	170	230	205	130	144	150	144	140	160	153	160	7.6	7.36	1.09	3 033	81	77	70	67	120	107	124	116	104	90	68	65	81	79	86	...	83	74	72	9.20	8.44	1.07
20	115.70	7 800	194	170	164	224	190	180	250	211	160	156	167	160	160	160	176	172	7.03	6.70	1.09	3 388	91	81	76	74	146	117	136	116	113	94	71	74	97	93	89	89	96	79	80	9.14	8.37	1.06
22	130.07	8 395	197	180	170	224	200	194	260	230	170	160	176	160	161	194	166	190	6.64	6.18	0.97	3 698	91	86	80	79	146	133	136	121	117	94	78	77	97	91	90	87	93	83	86	8.96	8.31	1.06
24	149.46	9 060	201	200	198	244	210	200	280	250	174	176	188	175	171	200	196	200	6.28	5.81	0.96	4 020	97	93	85	80	148	137	151	133	125	100	93	91	101	97	90	90	97	88	91	8.64	7.97	1.02
26	164.81	9 555	213	210	206	265	230	214	300	243	186	186	199	189	179	210	200	213	5.89	5.69	0.91	4 305	100	96	91	90	148	135	137	140	131	110	98	96	111	113	107	101	101	90	97	8.03	7.59	1.00
28	182.10	10 070	220	220	220	285	250	235	320	260	196	192	208	191	187	220	210	223	5.27	5.05	0.90	4 702	115	109	99	96	145	135	135	140	130	110	96	96	117	119	115	103	101	96	101	7.50	7.15	1.00
30	176.00	11 520	230	230	224	275	240	230	310	280	227	200	217	209	198	230	220	235	4.33	4.03	0.87	5 088	120	110	107	103	153	135	140	136	131	96	104	100	120	125	117	110	106	100	107	7.14	6.79	0.97
32	189.06	12 080	240	235	240	305	260	240	330	300	250	227	240	226	215	240	240	245	4.10	3.89	0.85	5 371	130	117	107	106	153	153	150	140	139	106	120	120	130	134	119	106	106	103	110	6.47	6.16	0.89
34	201.70	13 055	253	247	240	305	273	254	340	320	250	236	250	240	226	254	240	260	3.74	3.59	0.84	5 768	134	124	115	106	172	156	159	151	148	120	127	120	130	134	120	110	110	105	115	5.91	5.58	0.94
36	216.00	13 980	264	260	250	305	283	264	350	320	260	237	245	240	236	264	260	265	3.55	3.37	0.83	6 043	141	131	125	113	174	160	163	167	159	145	117	117	145	137	131	120	115	113	120	5.44	5.13	0.89
38	230.40	14 945	280	260	274	320	295	271	370	340	264	257	255	250	240	270	270	265	3.33	3.06	0.82	6 277	140	137	130	120	178	170	168	167	150	147	130	120	153	141	136	124	119	110	120	5.06	4.77	0.84
40	237.60	15 360	290	264	275	315	304	279	380	340	280	264	264	240	240	280	280	280	3.07	2.84	0.81	6 512	150	141	135	120	180	180	175	177	160	157	127	127	157	148	140	140	125	120	127	4.84	4.60	0.78
42	249.27	16 065	294	264	286	327	314	289	390	340	276	264	277	260	264	276	276	288	2.88	2.64	0.80	7 063	156	150	137	131	188	180	185	181	170	164	131	131	165	165	146	130	130	141	145	4.55	4.26	0.77
44	261.54	16 940	296	286	317	330	330	300	340	320	276	276	286	264	264	315	311	305	2.68	2.51	0.79	7 324	163	155	141	137	188	184	188	193	180	163	137	137	169	165	152	132	135	133	151	4.34	4.07	0.76
46	272.69	17 920	326	286	330	330	330	309	340	304	286	264	286	272	264	315	325	305	2.62	2.39	0.79	7 739	170	160	146	143	196	188	193	200	170	169	141	141	167	167	158	138	138	136	154	4.19	3.88	0.76
0	.....	.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10	10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Corrected for error of mercurial gauge due to the depression of the mercury in the reservoir.
The arrows indicate that the pressure was let back and readings taken on the falling pressure in the second column.

Column one of the table gives the pressure in feet of mercury; column two the pressure per square inch in the cylinders (this has been corrected for the errors in gauge due to the falling of the surface of the mercury in the reservoir); column three gives the total pressure upon the area of a cylinder 9 in. in diameter. The columns headed *W* give the actual weights necessary to move the cylinders against the friction of *the two packings* under the several pressures.

As two or more tests were made on each packing, it will be noticed how the friction reduced for the last tests in comparison to the first test, showing thus the difference between a new packing and the same after a moderate use. The difference due to the size of the packing is also shown by the several columns headed 1⅝, 1⅜, etc., and which give the width of the bearing side of the packing.

Columns twenty, twenty-one and twenty-two, headed "percentage for one packing," give the relation between the friction, reduced to one packing (the apparatus contains two packings) and the total pressure upon a ram of the size experimented upon. The first of these columns gives the maximum friction in percentage; the second, the average of all the tests; and the third, the minimum friction. So that the range can be seen at a glance.

It will be noticed that the relative friction reduces with the increase of the pressure per square inch for both sized rams. Also that the relative friction of the rams is less as the diameter of the rams is increased.

The assertion made by the writer in the discussion upon Mr. MACDONALD'S paper, that for such rams and pressures as were usually employed in testing machines the friction would not be one per cent. of

*From Transactions of the American Society of Civil Engineers; Jan. 1887.

the full load, and probably less than one-half of one per cent., is supported by these tests. These conclusions are confirmed by a comparison with HICKS' experiments.

In addition to the tests on the friction of hydraulic packing with the longitudinal motion of the plungers, tests were made at St. Louis upon the friction of rotating the plungers. They were made by inserting a lever in the eye-bolts shown on the drawing of the apparatus, and weighing at a fixed leverage the amount of the resistance to rotation. The following table gives an abstract of these, reduced to the circumference of the plunger:

AVERAGE FOR ONE PACKING.

Size of the Packing.	9-IN. RAM.		6-IN. RAM.	
	Pressure = 0.	Pressure = 273 lbs.	Pressure = 0.	Pressure = 273 lbs.
Inches.	Pounds.	Pounds.	Pounds.	Pounds.
1⅜	23	300	8	140
1¼	61	250	12	164
⅞	50	250	8	114
⅝	6	200	8	118
⅝	6	184	6	104
⅝	6	147	...	....

ABSTRACT OF HICKS' EXPERIMENTS.

FRICTION OF A PLUNGER ⅝-IN. DIAMETER, LEATHER WASHER PACKING.

Pressure per square inch.	FRICTION IN PERCENTAGE OF TOTAL PRESSURE ON PLUNGER.		
	New and stiff leather.	Leather used before.	Second leather.
Pounds.	Per cent.	Per cent.	Per cent.
10	26	18	18
20	12·5	8·5	13
30	12	7·6	10
40	10	6·5	10
50	9·6	5·4	9·6
60	9	4·9	9·0
80	5·6	4·1	7·7
100	5	3·8	7·4
120	4·3	3·3	6·3
160	4·7	3·0	5·6
200	3·3	3·3	4·8
240	4·1	3·4	4·1

FRICTION OF A PLUNGER 4-INS. IN DIAMETER.

	Leather, new and stiff, and sparingly lubricated.	Leather, well worn, and well lubricated.
Pounds.	Per cent.	Per cent.
188	4·6	2·13
446	2	1·25
673 to 5,865	1·55 to 1·07	0·95 to 0·63

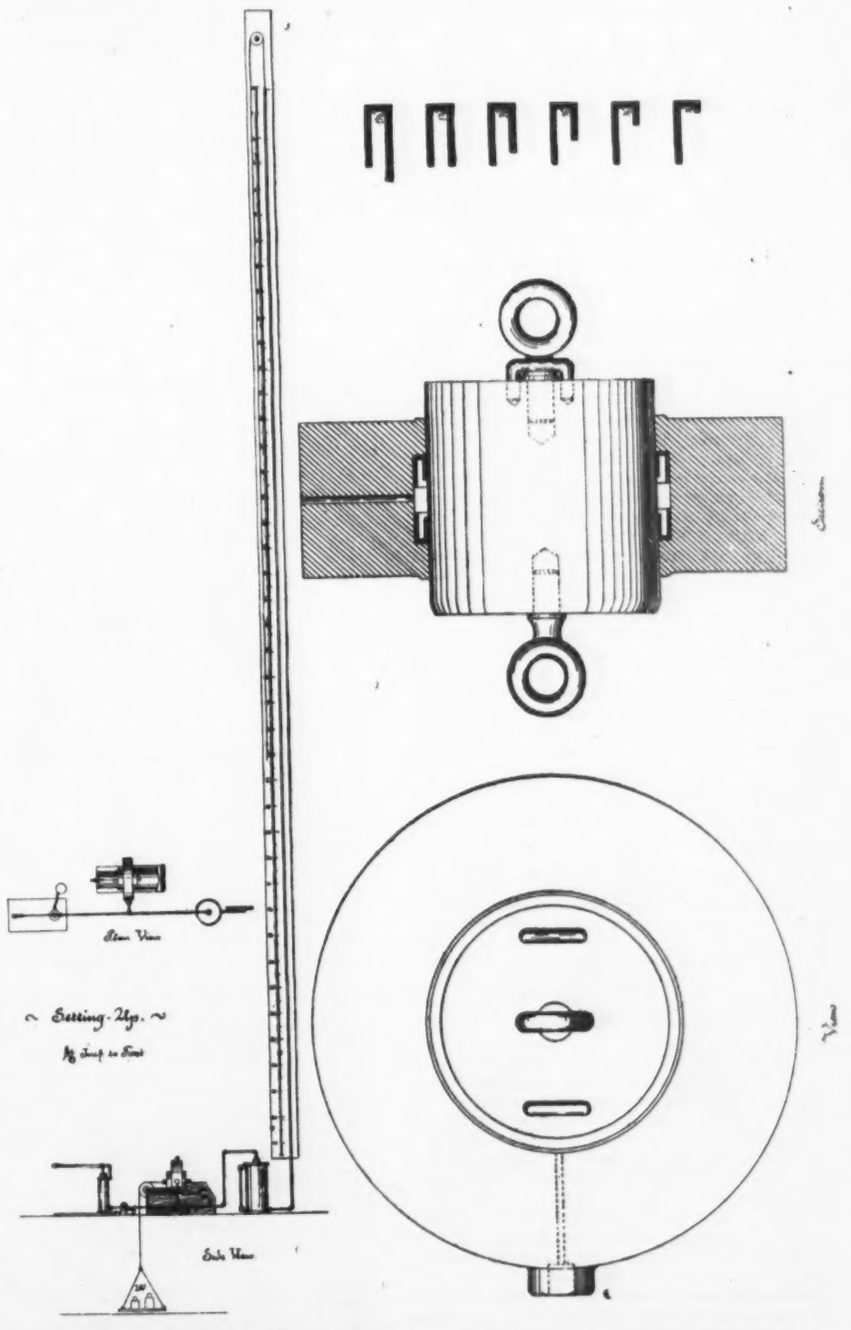
FRICTION OF A PLUNGER 8-INS. IN DIAMETER.

443 to 1,882	0·46	0·42
6,378	0·50	0·33

The Hudson River Tunnel.

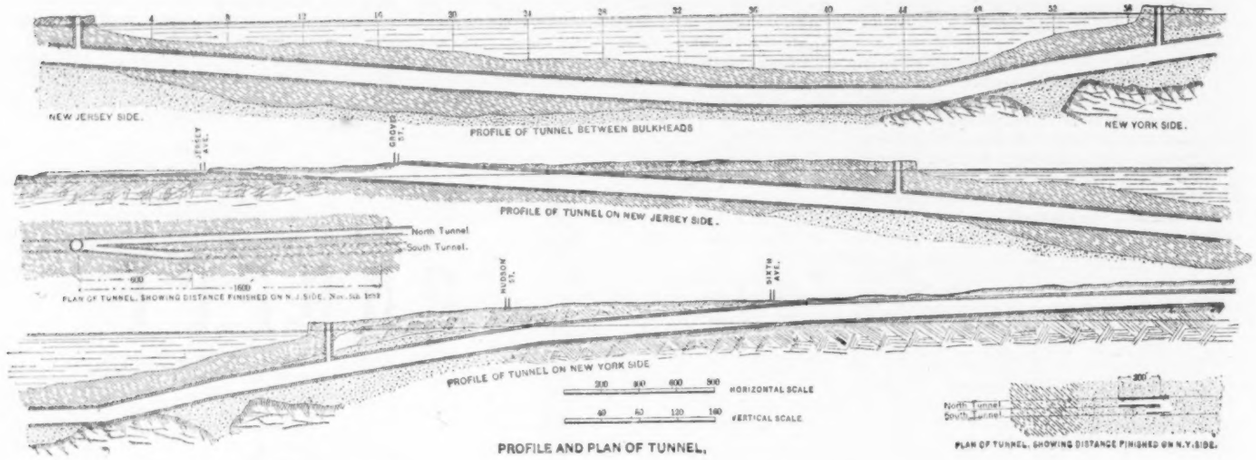
In the latter part of 1882 financial troubles compelled the stopping of all operations connected with the Hudson River Tunnel and the entire work was then flooded. Some five or six weeks ago steam was turned on at the New Jersey end, the water was pumped out down to the air locks when air was forced into the heading, silt that had crept into the tunnel was removed and the work of building was actively resumed and is now continued night and day.

Before describing the condition of the undertaking at the present time, it may be acceptable if we briefly glance at what has so far been accomplished. The first work was the sinking of a masonry shaft near the bulkhead wall on the New Jersey shore, and half way down in the side toward the river an opening was made to receive an air-lock. Air under pressure was admitted to the lock, the inner door of which was opened and the material excavated to allow the placing of iron plates forming a cylinder that was, practically, a continuation of the lock. From the river end of the cylinder, rings of plates were erected, the rings increasing in diameter and as their upper portions were in the same line, their bottom portions constituted a series of steps, the whole thus forming a sort of funnel, having an upper horizontal side and a lower inclined one. The air-lock was located at the small end of the funnel and from its large end projected the two tunnels, each of which measures 16 ft. in clear height by 18 ft. clear width, the masonry being 24 in. thick. (As the tunnels advanced this was increased to 30 in.) After the two headings had been extended some distance the work of removing the funnel, or "temporary entrance," as it is called, was begun in order to unite the shaft and tunnels by a masonry chamber. While this work was in progress the roof plates next the shaft gave way, blocking the entrance to the lock, so that the inner door could not be closed, thus preventing the escape of twenty men who lost their lives in the flooding that followed. The work was again opened by sinking a caisson between the ends of the tunnels and the shaft which were then united by one large masonry chamber built within the caisson. The headings were then carried forward, and at the present time the north one is 1,600 ft. and the south one 600 ft. from the shaft. The caisson proved to be so well adapted to the work that the idea of a shaft from which to start the New York end was abandoned, and a caisson was sunk and from this the tunnels were started, the north one being 300 ft. and the south one 30 ft. from the side of the caisson. The work at this side varied most essentially from that at the other, and was very much more difficult as the caisson rested entirely in fine sand which extended toward the river in a downwardly sloping direction, the inclination being such that it would pass below the line of the tunnel at a point about 200 ft. away when the tunnel would pass through silt alone. When work was stopped, four and a half years ago, each of the headings operated was being advanced at the rate of from 3 to 5 ft. a day and the prospect, as far as the material to be passed through was concerned, appeared extremely favorable.



Illinois and St. Louis Bridge Company.—Apparatus for Testing the Friction of Hydraulic Packing

In the above we have said nothing about the method of building the tunnel as the plans now


NEW JERSEY SIDE.
PROFILE OF TUNNEL BETWEEN BULKHEADS
NEW YORK SIDE.
PROFILE OF TUNNEL ON NEW JERSEY SIDE.
North Tunnel.
South Tunnel.
PLAN OF TUNNEL, SHOWING DISTANCE FINISHED ON N.J. SIDE, Nov. 5th 1883
PROFILE OF TUNNEL ON NEW YORK SIDE
HORIZONTAL SCALE
VERTICAL SCALE
PLAN OF TUNNEL, SHOWING DISTANCE FINISHED ON N.Y. SIDE.

PROFILE AND PLAN OF TUNNEL.

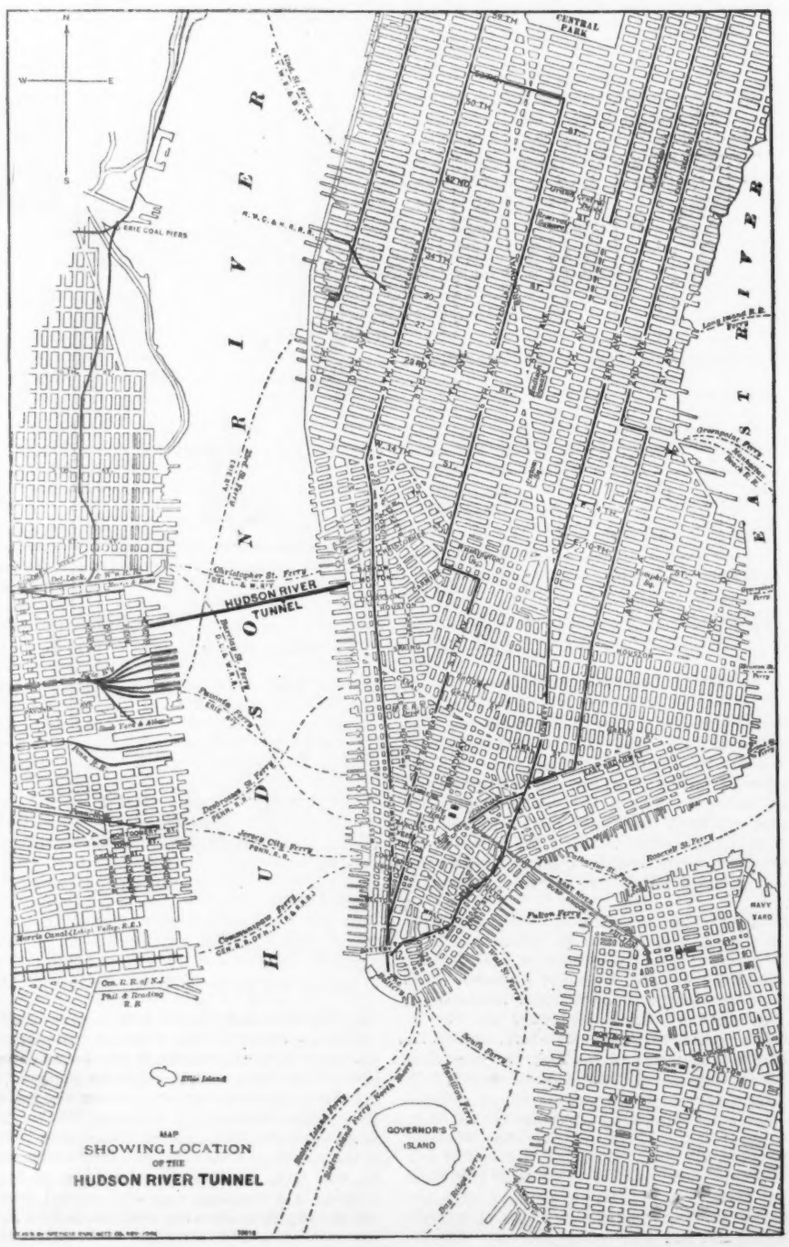
pursued are identical with those formerly followed.

The writer recently visited the tunnel, passed through the two locks and entered the heading of the north tunnel, noting as he went the aspect of affairs and paying particular attention to the appearance of the old work which had been for so long a time under water. The visitor to the tunnel has the choice of two ways of reaching the bottom of the shaft—he can ride down on an elevator or propel himself down steep and crooked flights of steps. Most people decline the propeling process, preferring to risk a drop of 60 ft. with only one stop at the bottom, rather than slide down stairs having "stops" every six inches. At the bottom of the shaft we meet an old familiar friend in the shape of a small steam pump whose duty it is to keep the shaft free from water and to furnish water to the masons at the heading. This pump has been subjected to all kinds of hard usage; it has been under water for years at a time and its supply of water has frequently given out, yet it has never balked nor hammered its head out. Admit the steam and it always seems to be ready to obey. We passed quickly down the tunnel to the first air-lock which is in a masonry bulkhead 800 ft. from the shaft. This lock is 6 ft. in diameter and 16 ft. long. Emerging from this lock we were in the middle section of the tunnel and under an air pressure of 22 lbs. to the sq. in. Hurrying along, the second lock, like the first in every respect, was reached at the end of 400 ft. Through this and we were in the last or heading section, the pressure being 27 lbs. Four hundred feet further—1600 from the shaft—and we saw the heading itself. So far we had made no notes, leaving that for the outward journey, for the simple and sufficient reason that if, from any cause, our stay in the heading should be indefinitely prolonged the notes would be no good and our time would have been wasted.

When the tunnel was opened it was found that the silt had forced its way through the timber bulkhead erected at the heading and had entered the tunnel for about 100 ft., making a sloping deposit the full size of the tunnel at its wide part. When the heading had been cleaned out it was found that the pilot from some unexplained cause had shifted two or three feet toward the north, but as the movement had been along its entire length it sustained no injury. The end of the masonry was perfect in every part but the projecting plates of the outer iron sheathing had been bent and twisted,and had been forced outward at the north side. The silt was found to be compact, tenacious and therefore admirably suited to this method of tunneling.

The pilot is a tube 6 ft. in diameter, built up of interchangeable flanged plates. The head of the pilot extends from 15 to 20 ft. beyond the tunnel heading while its rear end extends far enough within the completed masonry to be firmly braced. The tube then forms a rigid core or hub from which the plates can be supported by braces. A cross section of the heading exactly resembles a wheel, the hub being the pilot, the spokes the braces, the felloes being the masonry and the tire the sheathing. The silt is dug away enough to admit a plate (the plates now used measure $2\frac{1}{2}$ by 4 ft., and each edge is provided with a flange through which bolts are passed,) which is

The Hudson River Tunnel.



then bolted to those already in position. In this way ring after ring of plates is put in until a section, usually 10 feet, has been completed. The top plates are kept a little in advance of the lower ones to more nearly follow the cutting of the heading. After a section has been ironed, it is cleaned out and the brickwork laid, the cement being mixed in the proportion 1 cement to 2 sand. The centering for the arch consists of angle irons bent to the inner arch, upon which strips of wood are laid. Owing to the outward bulging of the old plates at the north side, it became necessary, in the section being built at the time of our visit, to extend the brick work to meet them, and that side of the tunnel was being put up 4 ft. thick. This insures a good union with the old work and obviates an offset in the line of the plates. To bring that side of the plates back into line wedges are inserted between each ring, so that, little by little, that side will be brought back to place.

The work is divided into three parts: One gang excavates the silt at the heading, another puts in the plates and braces them from the pilot, and the third lays the masonry. In this way there is no lost time and the work advances at a regular rate. No attempt is made to cover the heading with sheathing, but braced planks are placed against it to prevent the possibility of a large lump falling. Except where so covered the heading is entirely exposed, the tenacity of the silt itself being depended upon to resist any pressure that may result from a difference in the air pressure upon the interior and water pressure upon the exterior. The silt forms a wall dividing the air and water.

When passing out of the tunnel, we looked carefully at the walls of the old work and found no signs that would indicate that the long flooding had done any harm. The locks looked decidedly weather-beaten, but it would take a closer inspection than we were then able to give to find out if their strength had been impaired. All the material is passed through the locks on cars, which run down by gravity and are drawn up by mules. Between the two locks is a mule, which draws up the excavated material. This animal seems to be contented with his work, and appears to thrive under compressed air.

It is stated that all the funds necessary for pushing the work as rapidly as possible, have been obtained, and that the other three headings will be opened as soon as men have been trained to the work.

THE English *Blue-book* for 1886, shows that in the year ending Dec. 31, 1886, 8 passengers on the railways of the United Kingdom were killed and 615 injured from accidents to trains, rolling-stock and permanent way; 87 passengers were killed and 727 wounded from other causes, such as falling between carriages and platforms, getting in and out of carriages, etc. This gives a total of 95 killed in 1886, as compared with 102 in 1885; while the total wounded was 1,342 in 1886, and 1,129 in 1885. Only 4 employés of the companies are reported as killed and 81 wounded by accidents to trains; but 421 employés were killed and 1,929 wounded by other causes. The sum total for 1886, including accidents occurring on the premises, but not caused by the movement of vehicles, is 989 killed and 7,407 wounded.

IT is stated that a number of new engines which have recently been turned out from the Southern Pacific shops at Sacramento prove that they can really build locomotives more profitably in their own shops than they can import them from the East. A few months ago bids were received from Eastern manufacturers for the construction of four engines, the lowest tender being $14,000. The price was considered too high and the work was commenced at Sacramento, the result being that the four engines were turned out for the sum of $9345.33. All are provided with what is known as the Stevens valve gear, which effects both a forward and backward movement from one eccentric, as well as a more perfect distribution of steam. There is also claimed to be a great saving of fuel.

Bursting of a Water Tank.—The wooden tank on the water-works tower at Newport, Ark., burst May 6, wrecking the engine room and a residence, and injuring two persons, but not seriously injuring the machinery. The tank was full and contained about 50,000 galls. of water. According to reports the pressure burst the iron hoops,

Masonry Arches as Roof Supports.

BY L. V. TIEDEMANN.

Translated from Centralblatt der Bauverwaltung.

Great progress has been made in the construction of fire proof roofs since the edict requiring their use for certain buildings was issued by the Prussian Minister of Public Works.

Heretofore iron has been largely used for this purpose, but of late years, roofs, built of masonry, have found much favor.

In the present article, the author has undertaken to point out the fundamental principles underlying the construction of the latter.

Roof trusses are placed at such intervals that the intervening space may be readily spanned by portions, which, in turn, serve as a support for the rafters, or the roof covering may be placed directly upon them.

As many roofs are slated, it has not always been considered necessary to construct the rafters of fire proof materials, for the reason that slate requires a wooden sheathing for its reception. In introducing stone in the construction of roofs, only the iron portions are intended to be replaced by masonry. On this account, an ordinary masonry arch supplies the best form of roof support.

In its construction, the following points must be taken into consideration:

1. The line of resistance of the arch is most regular where the loading is uniformly distributed. This condition exists more fully in roofs in which only purlins (to the exclusion of rafters) are used, the purlins being placed close enough to receive the roof covering directly.

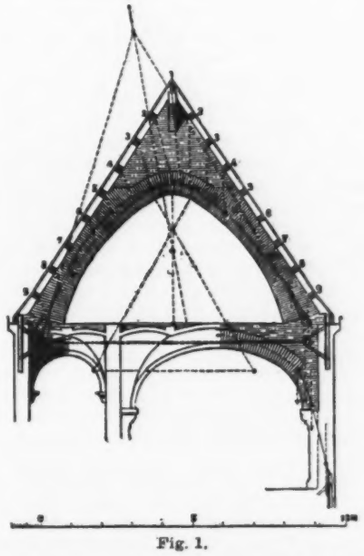


Fig. 1.

2. Suitable abutments for the roof arches must be provided. Where fire-proof roofs are required, the ceilings must necessarily be such too. If partition walls do not exist, the spandrils of the ceiling arches can be used to advantage for the abutments.

3. As a rule the upper walls are too weak to resist the horizontal thrust, consequently the arches must be tied together. The space between the roof and ceiling arches is admirably adopted for placing the anchor or tie rods.

4. The longitudinal connections are obtained by means of masonry arches, those at the gables being oval shaped, thus also tending to strengthen the whole roof. The ridge space is well adapted for the placing of these longitudinal arches, sufficient room for the skew facks being easily obtained.

5. The shape of the arch is greatly dependent on the form of the roof, the flatter roofs requiring the lightest arches. Steep roofs present a larger wind surface and the resulting strains demand a greater depth of arch.

Pointed arches are best adapted to steep roofs.

Widths of 10 to 12 m. (32.8 to 39.4 ft.) can be spanned by a single arch. In greater spans, the skew backs may become so wide so as to preclude the use of the ceiling arches for their support.

In such cases it is best to construct the support of several overlying arches relying on intermediate points for additional support. (Fig. 3.)

Fig. 1 represents an arch for a steep roof, having a height of 7.5 m. (24.6 ft.), the width of the building being 10 m. (32.8 ft.)

The wind pressures cause a variation in the line of pressure of nearly 30 m. and thus regulate the depth of the arch stones. The outer surface of the arch conforms to the general slope of the roof. In the portion above the arch the masonry courses are laid horizontal up to the ridge.

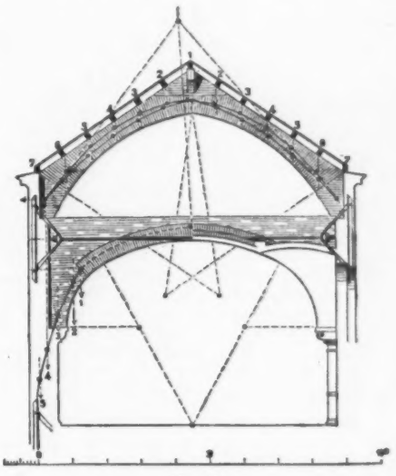


Fig. 2.

The building has an entry on one side 3 m. (10 ft.) wide. The rooms which compose the other side are 6.5 m. in width, and are spanned by a single ceiling arch without need of strengthening the side walls, dependence being placed on the tie rod of the roof arch.

This form of ceiling will to a great extent obviate the use of iron beams and their accompanying intermediate arches, which are not always to be admired from an artistic point of view.

With larger spans the thrust of the arch increases considerably, and in order to supply a sufficient counter pressure, the roof arch can be made flatter, increasing the load and thrust of the same, or increase the upper leg of the tie anchor. The latter mode is preferable, requiring less masonry and does not decrease the attic space so much.

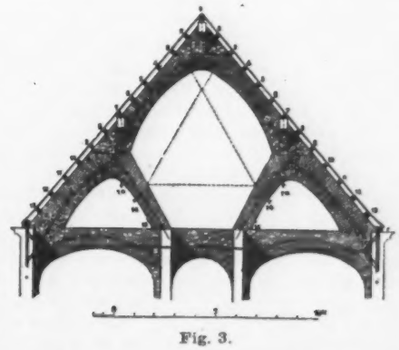


Fig. 3.

Fig. 2 furnishes an example of such an arrangement. This roof has a rise ⅛, the walls being carried 1.5 m. (4.9 ft.) above the level of the attic floor. By the use of these walls or cornices, the upper leg of anchorage plate can be lengthened at will, thereby increasing the resistance of the horizontal thrust and making larger spans admissible.

Fig. 3 shows an arrangement of roof trusses in which the partition walls serve as supports. The width of the roof is 17 m. (55.76 ft.), having a rise of 10 m. (32.8 ft.) On account of the great height of the roof it is advisable to support these trusses by three longitudinal arches, placing one on either side of the central one, about midway between the ridge and the eaves.

ENGINEERING NEWS

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D. McN. STAUFFER. A. M. WELLINGTON.
EDITORS.
GEO. H. FROST, - - - BUSINESS MANAGER.

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WE are compelled to postpone until next week presenting some further facts in relation to the Latimer safety-guard patent—now and for some years past controlled by Mr. W. J. MORDEN, of Chicago, Ill.—for lack of space. We are sure these facts will be examined with general interest.

WE give in another column our regular monthly summary of the weather of the United States for April in the details of most interest for engineers, which in several ways will be found interesting if compared with our record for March, in ENGINEERING NEWS of April 16, 1887. One of the most notable things is the comparative velocity of the wind in March and April. It will probably surprise many to find that the alleged fierce winds of March do not by any means show up in the statistics. They are very disagreeable, but they are not particularly violent. The further interesting comparisons which may be drawn, our space does not permit us to note this week.

WE hardly need call the attention of engineers to the diagram in another column accompanying a communication of Mr. ALFRED D. OTTEWELL, C. E., which presents in a graphic and striking way the diversities which exist in various modern formulæ for proportioning bridges. Practice is now in something of a transition state in these matters, and while there has been a decided advance from past practices which were unquestionably bad, both in respect to rolling loads and unit strains, we have by no means reached the point where practice has settled again on other things which are unquestionably good, nor are we likely to at once. We cannot attempt in this issue to discuss in detail the questions raised in Mr. OTTEWELL'S paper, especially as we hope, by waiting, to have it more ably done by some of our numerous readers who have made and are making a special study of those questions. One thing however may be said with certainty,—we have been sailing too close to the wind in the past, in proportioning the smaller structures especially, and there is one fact in connection with our iron bridges, which has not attracted the attention which it ought: Because we have had few — marvellously few — failures of iron bridges from inherent weakness in the past, it does not follow that we shall continue to be so fortunate in the future; rather the chances are that we shall not be. We must remember that the Ashtabula bridge, which fell at the end of 1876 after a life of 11 years, was one of the very first iron railway bridges erected in this country. Even when it fell, the number of iron bridges in the country was hardly one-fifth of what it is to-day, we should judge, and possibly much less, and of all that were then standing there was hardly one of the smaller structures, say of those under 200 ft. span, that would pass inspection according to the standard of to-day.

When the Asthabula bridge was getting ready to fall, the Bussey bridge was getting ready to be erected. Both of them in their different ways were about as bad as they could be, and no engineer in his senses, who knew just what they were, would have trusted them to carry even one loaded train, yet both of them managed to hold together for eleven years in some miraculous fashion, and if the history of bridge disasters be investigated, it will be found to be almost the rule for even the worst bridges to hold up somehow for eight or ten years before they finally come to grief.

This being so, what is likely to begin to happen soon to the multitudes of old iron bridges throughout the country which are now passing through their second decade of life? We are but beginning to have any *old* iron bridges in the country to fall down, but it is full of those which are beginning to grow old. For example, there are still a very large number of old Bollman bridges on the Baltimore & Ohio—a road which is now running the heaviest coal cars in the country, weighing 3,614 lbs. per lin. ft. We know nothing about their real margin of safety. They may be among the strongest and safest in the country, and we mention them only as the most prominent examples which occur to us of old bridges carrying new loads; but reasoning only from probabilities, and remembering that these bridges date back to the years when engineering was young, we judge it to be highly probable that when the fullness of time has come the unexpected will happen to them and many others like them, in increasing numbers, unless they are renewed in time, which in the nature of things will not always be the case.

The question of safe bridge designing will then come still more prominently to the front, and the engineer who cannot show that he has been abreast of the latest necessities may find himself in an embarrassing position.

The St. Gothard Railway Grades.

A correspondent sends us a query in regard to the discussion of the location of the St. Gothard Railway, which we published in our issue of April 16, 1887, directed more particularly toward the following quotations from our article:

"By the aid of the long table 170 (see ENGINEERING NEWS, March 12), we may see how much real economy was effected by these developments in taking the traffic from Silenen to the St. Gothard tunnel. *Neglecting the actual distance, which it would be unfair to consider,* (our correspondent interpolates a query as to the italicized phrase) we may say, that the length of the mountain grade in miles, would be about inversely as the rate of grade. Then we have, for a heavy consolidation."

Grade per Mile.	Comparative Length.	Comparative Net Tons.	Load of Eng. per cent.	Comp. Eng. Miles per Through Ton.
137.5	160.0	319	100.0	100
197.5	69.3	210	65.9	105
219.0	62.5	184	57.7	108
237.5	57.5	165	51.7	111.5

The reason why it "would be unfair to consider the actual distance" in such a comparison, is simply that it would or might unduly favor the higher grade by comparing it with the actual low grade, on which there was considerably more lost elevation, for stations and otherwise, than the nominal grade called for. This lost elevation, on a given ascent, should be approximately a constant per cent. of the total rise, whatever the rate of grade, any variation therefrom being likely to be in favor of the lower grade.

Our correspondent adds:

"This table shows that the grade of the St. Gothard Railway, 137 ft. per mile is the most economical one. This is acknowledged by Mr. WELLINGTON himself. Still he is of the opinion, that the steeper grades and straighter lines are more economical. Is not this self-contradictory?"

Here our correspondent falls into a very common error. "This table," which he quotes, shows nothing of the kind, except as respects *one* of the *many* details to be considered before finally concluding what is economical. Had the table been continued for grades between 10 and 137 ft. per mile it would show that each one in succession was still more economical in motive power (by a slight percentage) as a level was approached. Would our correspondent therefore reason that more and more spiral tunnels for the pure sake of development would have been justifiable, merely for the sake of saving this slight percentage in motive-power? Clearly not. The true way of looking at the matter,—for comparing, for example, the 197 ft. and 137 ft. grade is this: "The lower grade will save 5 per cent. in engine mileage for the same through traffic. How much will that save in the total operating expenses?" It will really save something less than 2½ per cent. Then, "What will be (or what are) the total operating expenses for the particular section of mountain track concerned?" Taking 2½ per cent. of that sum we have the total yearly saving from the lower grade. Then, on the other hand: "How many million dollars will the spiral developments and other necessary works to get the lower grade cost; what will be the extra maintenance cost per year on the extra track; what will be the extra cost due to the curvature introduced?" etc. When this has been done it will be found that no imaginable assumptions will show that the saving in motive power from the lower grade can balance the extra cost of the tunnel developments to obtain it. *Therefore*, it is unwise, even if it does result in a trifle more motive-power, while on the Italian side, the spiral developments did not even serve to give a lower grade, but only to introduce a few almost useless stretches of much easier grade.

There is a broad distinction in the value of reducing grades in such cases as this, when the high grade is a separate feature, operated by separate locomotives, and when the grades are what may be called through grades, which fix the weight of trains for 100 or 150 miles, although perhaps only 5 or 10 miles long themselves. In the latter case the rate of grade is very important indeed, but it makes a very trifling difference whether we make a rise of 1,000 or 2,000 ft. on a 2 per cent. or a 4 per cent. grade, if the distance varies in proportion with the grade, *and* if the engine power needed on the high grade, is used only on the high grade, and not thrown away by a continued run on the low grade.

Our correspondent also asks if there are any examples in the United States of lines of such high grades as were suggested, 3 to 4 per cent., with so large a traffic as the St. Gothard. There certainly are not, but the reason is simply that there have been no such topographical difficulties to cope with in any part of the United States as on the St. Gothard line, unless in Colorado, where 4 per cent. grades are used with perfect success and with

a pretty large traffic. Such appeals to precedent, however, are nothing to the purpose. Every line is a problem by itself. It is well enough established what locomotives will do on various grades, and the question was, or should have been: What can a properly designed locomotive do on this and that grade, and what will be the comparative cost of doing it? Had the problem been grappled in this spirit, it would have thrown out most or all of the spirals, as it would have thrown out the absurdly limited maximum curvature (5° 48′) no mechanical or financial defense of which is possible. As we stated in our former article, no claim can reasonably be made that a better article of curvature was wanted, and hence a better price had to be paid for it. "A vast sum was spent to obtain something which was worth little or nothing after it was obtained, either for safety or economy in operation. The most which can be said, therefore, in contemplating these features of the design, is that it is magnificent, but it is not civil engineering, for civil engineering consists in accomplishing desired material ends in the best way."

A Question of Dynamics.

A valued correspondent sent us some two weeks since the following note in reference to the illustration of "A Strange Collision" which appeared in our issue of April 9. By a series of chances it has been crowded out of several successive issues, as was also, for one issue, the letter to a similar purport from another correspondent which appears elsewhere:

"As to the climbing of the passenger on the freight engine in the collision, (ENGINEERING NEWS, page 235,) I cannot but question the adequacy of the explanation that it was due to the fact that the freight engine was *standing still*, while the other was *moving*. A candle would, I think, penetrate a board just as well if the candle stood still and the board moved toward it with the same velocity (*B*) or if the two approached each other, each with *half* of the velocity of the fired-off candle (*A*) or in any other manner provided the relative velocities were the same as in the first instance. All velocity is relative. Indeed if we were to establish an analogy between the trains and the moving candle which penetrates the thick board, we should rather expect to see the moving engine insert itself under the fixed one. I do not feel sure enough of my position to wish to appear publicly as its occupant, but I think you will agree with me."

It is our misfortune that we cannot fulfill our correspondent's closing prophesy. The reasons why we cannot are these:

(A) Whether two trains in collision had each a velocity of 30 miles per hour, or one 60 and the other none, or one any fraction of 60 miles and the other the rest, makes no difference in the velocity of approach, but it makes a very material difference in the force with which they will come together, and in what will happen thereafter. The total energy in each train being as $M v^2$, we have in the first case $M\ 30^2 \times 2$, and in the other $M\ 60^2$, *or just twice as much*. As this energy is all destroyed in the collision, just twice as much crushing and breaking must take place in one case as in the other. The popular phrase as to such trains having "a united velocity of 60 miles per hour" embodies merely a popular fallacy — which is a remarkably common one.

(B). It is well enough known, and has frequently happened in battle, that if two leaden bullets happen to meet in mid-air they will be flattened into an almost solid "oblate spheroid." Nearly enough for practical purposes we may say that their velocity under such circumstances would be about half their muzzle velocity.

Would the same result happen if one bullet having nearly its muzzle velocity impinged upon another one which was stationary? We do not know; and like our correspondent, do not care to put ourselves absolutely on record, but the experiment is one easily tried by putting a bullet against a bank of earth and firing at it from a point near at hand, and our opinion is that the result will be quite different. The bullet in motion will split the one at rest, or go right through it, as a candle will through a board, yet according to our correspondent, the effect will be precisely the same because their velocity of approach to each other is the same.

We hope someone may be moved to try the experiment and let us know the result. It might take several trials to hit the bullet fair and square, but it ought not to take many from a distance, say of 10 ft.

What took place in the collision referred to was probably this: The two pilots would be the first parts to come together, and would necessarily break or bend downward. Now in the case of two engines approaching each other with equal velocity this would give a slight upward lift to the front ends of *both* engines at the instant before they came together. It might not be much, although the pilot is rather a solid structure, but it would be ENOUGH, if it were anything at all, to give a slight upward angle to the intersections of the two lines of force; in other words, the two forces would not be *precisely* "equal in magnitude and opposite in direction," so as to completely neutralize each other. To maintain stability, and keep the bodies at rest (except for internal crushing) after they have impinged upon each other, the vertical component resulting from the obliquity in the two horizontal forces must be counterbalanced and neutralized by the action of gravity. But as the horizontal pressure in pounds is, for the instant, almost infinite in magnitude the slightest upward angle in their line of direction will create a vertical component which gravity will not be able to counterbalance, and the forward ends of the two locomotives will rise in the air, so that, in some cases, they will stand almost vertical. Various photographs of locomotives in this position have been taken and published under such title as "The Embrace of the Leviathans." "The Dance of Death," "They Met by Chance," etc.

But when only one engine is in motion, although both pilots may be smashed down, yet only one of them tends to give a vertical component upward. Consequently, one will have a tendency to mount the other. If the pilots or other equivalent parts which would break downward, or in some other way produce an upward reaction, were absent, we apprehend that this tendency would not and does not occur, whether one engine only or both engines were in motion. At least, we recall no instances from our limited knowledge of European experience, *but the tendency having once begun*, we apprehend that it is helped materially by the fact that all the energy which is doing the work is stored in the body which has the most work to do. We have no belief that if two engines came in collision, with an equally slight tendency for the one in motion to burrow under the other instead of climb over it, whether from difference of level or otherwise, that the same result would follow as our artist pictured in the engraving referred to. It is easier to assert this than to prove it, and we will not positively assert it, but we feel that degree of certainty about it which is involved in bets of new hats, and that sort of thing, and we commend it to all our readers as a profitable field for experimental investigation. There are a good many apparent paradoxes in dynamics, and especially in that department of it which relates to the laws of impact and projectiles. Unless we are mistaken, our two correspondents have taken hold of the wrong horn of one of these, for we cannot but think that the two locomotives in our picture could not by reasonable possibility have gotten into their relative positions had the one beneath been the one in motion. We are, however, open to conviction, if anyone still maintains the contrary.

The Union Pacific.

"Be sure your sin will find you out" is text which is probably remembered vividly by the present management of the Union Pacific. Much of its present embarrassment can be traced directly to lack of foresight and good sense in its past management, but its present status is a pretty hard one. Its financial condition may be fairly compared with that of a man whose estate is incumbered by debts incurred by a dishonest or negligent guardian; and his business success forever hampered thereby. At the last session of Congress, a strenuous effort was made to effect an equitable adjustment of claims against the company, and give it at least the benefit of time to heal the wounds of its treasury. But the bill was suffered to lapse without action. With its finances in this involved condition, with its through traffic divided with lines, north and south, with strong rivals encroaching upon its none too productive territory, there was every reason for its rivals to feel that they had it on the hip. Public opinion is against the Union Pacific, and the newspapers have only mirrored general sentiment when they have published slurs and canards, stories of disagreements and mismanagement in the general offices, and even sneers at its president, who may not be infallable, but who is certainly one of the ablest and one of the most conscientious men in the whole list of our railroad managers.

The climax was reached—so far at least as employés were concerned—when, a couple of months ago, a general order was issued to call in all field parties, stop all new construction, and reduce office expenses to the lowest possible point.

Since that time, however, it would seem from appearances that the tide of affairs has taken a turn, and that Mr. ADAMS will be able to steer his unwieldy ship away from the rocks which threaten it. The offices have resumed their wonted busy aspect; not a few surveying parties are in the field; and construction is again in progress. And now it would seem that Mr. ADAMS, when he spoke so ably a short time ago on railway consolidation, may have had an idea of practicing what he then preached. The Union Pacific has gained control of the Oregon Railway & Navigation Co., and the Oregon & Transcontinental Co., and it is intimated that the latter purchase points toward more harmonious relations, at least, with the Northern Pacific.

Moreovor, recent developments are said to indicate an alliance of even greater importance in another quarter. The transfer of Mr. F. J. POTTER from the Vice Presidency of the Chicago, Burlington & Quincy to the General Managership of the Union Pacific, taken with the late agreement of the two companies to build a joint line of 80 miles in Colorado, may point toward a closer alliance than mere friendship. While an actual consolidation is not at all to be expected, and would require too much readjustment of present conditions to have its results clearly foretold, there is no visible reason why a union sufficiently close to permit intimate traffic relations, and a mutual understanding as to the occupancy of new territory, would not benefit both parties,

and be one more step toward that inevitable and beneficent end, the still more general consolidation of our multitudinous transportation companies into a few great systems, harmoniously and efficiently operated for the general good. Already, half the mileage of the country is operated by only fifteen different managements, and while it may hardly be for the public interest to have the number of such great corporations reduced much further, yet it is almost sure to be advantageous to have lines which would otherwise be cutting each others' throats unite their interests.

Uniform Draw Bars and Couplers.

The necessity for securing a uniform automatic draw bar and coupler for the freight train service of the United States has been for many years admitted in theory by railroad managers; it is now proposed, and we hope in what will prove to be a practicable way to recognize that necessity in practice. An agreement has been entered into, we are informed, by railroad companies representing between one-fourth and one-fifth of the aggregate railroad mileage of this country, under which a committee is appointed to make thorough tests of the various automatic drawbars and couplers, recommended for further trial by the Executive Committee of the Master Car Builders' Association, and such other couplers as may be recommended by five representatives of said Association, with the understanding that the device approved, as the best by a majority of the Committee, shall be adopted as their standard in all new equipment, and all repaired equipment by all the railroad companies, parties to the agreement. It is believed, and we earnestly hope with reason, that this movement so happily inaugurated for the solution of a complicated problem of railroad operating and management, must ultimately assume a national character and that the solid phalanx of thirty thousand miles which, if our information is correct, now confronts the car coupler difficulty, is but the advance guard of a much larger army which is being enlisted to contend for the principle of uniformity in car coupling, and for resultant operating economics. If this belief is correct, there is the greater necessity for intelligent selection of and discreet action by the Committee, to whom the final settlement and arbitration of such momentous interests have been intrusted.

A careful review and study of the personnel of the Committee will be very likely to inspire railroad companies, exhibitors, and an interested general public with an assured confidence in the thorough character of the tests about to be made by the committee and in the justice of its awards. The preliminary trials will be made in New York City on Wednesday 25th inst., or as soon thereafter as practicable and the devices of the various competitors will be subjected to the most exacting tests, both as to their general practicability in actual service, and their endurance under varying physical conditions of strain tension or impact. The Committee, as at present constituted consists of:

WILLIAM P. SHINN., Vice Prest. New York & New England R. R. Co. Chairman.

A. G. DARWIN, President Strong Locomotive Company.

C. A. HAYNES, Inspector Locomotives, Cars etc., Missouri Pacific system.

T. L. CHAPMAN, Supt. Motive Power, Newport News & Mississippi Valley Co.

F. M. WILDER, late Supt. Motive Power. N. Y. Lake Erie & Western.

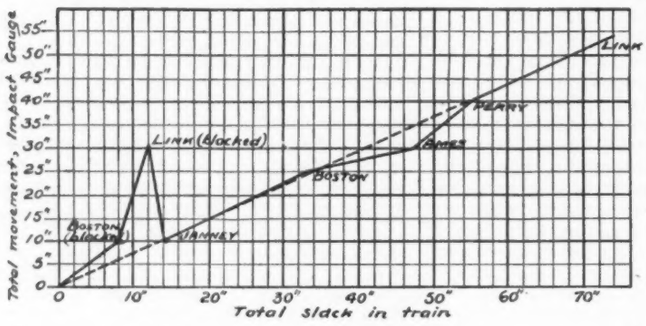
REUBEN WELLS, late Second Assistant President, Louisville & Nashville R. R.

JAMES MEEHAN, Supt. Motive Power, etc., Erlanger system.

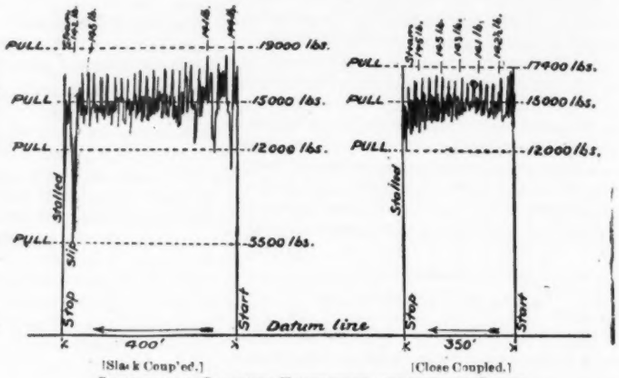
W. T. SMALL, Supt. Motive Power etc., Northern Pacific R. R.

Communications on this subject, we are informed, should be addressed to EDWARD VERNON, Secretary, care of W. P. SHINN, Vice-President, 36 Wall street, New York City.

As to the very important question of how the details of these tests, and of the awards based theron, are to be made, we are not at this writing fully advised. But the movement is certainly a needed one, and we hope will be as well managed in its details as it is timely.



COMPARATIVE CONCUSSION FROM SLACK.
(Showing it to be directly proportional to the slack.)



COMPARATIVE STARTING FORCE WITH AND WITHOUT SLACK.
46 empty 34 ft., cars and dynamometer car; 17 x 24 engine; grade, 53.8 ft., per mile.)

Slack Tests on the Chicago, Burlington & Quincy Railroad

The accompanying diagrams will help materially to interpret the results of the recent slack tests which we reported in part last week, since the diagrams show the result much more conclusively than any figures can do. The horizontal lines in the first diagram represent the number of inches of movement of the impact gauge; the vertical line, the inches of slack in each train. The inches of impact are taken from the total for a complete trip of four stops, and the average for two trips was taken, when much difference was found.

In the Janney, we find on the diagram 14-in. of slack and 10-in. of impact. (The figures we gave last week, which showed only 12½-in. of slack were incorrect.)

In the Boston we find 33-in. of slack and 25-in. of impact. (These tests we did not report last week.)

With the Perry we find 55-in. of slack and 40-in. of impact. The same reading may be made regarding the loose link.

An interesting point in regard to this first diagram is that a straight line drawn from the link stop to the zero point brings the Perry, Boston and Janney in line, the Ames only being a little out of line. It was found with the Boston coupling that there was 1⅛-in. slack with each coupling. This was after-curves, should have been made with a hook coupler. This was not done, however, inasmuch as the cars that were being tested with the vertical hook couplers (60,000-lb. cars, new) were so much heavier than the link and pin couplers (40,000-lb. cars, old) that it would necessarily have increased the resistance with the same number of cars, and to have dropped off any cars would have given opportunity to say a close coupled train could not so easily haul as many cars around the curve as a loose coupled train.

This second diagram indicates that there was a slight margin in starting power in favor of the train with slack, but so very slight a one as hardly to be worth talking about, while the concussion diagram is very conclusive in favor of eliminating slack.

wards blocked out, also the link was blocked out, bringing about the irregular result as shown in the left hand corner of the diagram. The fact of there being this 1½-in. slack in the Boston coupler shows that a vertical hook coupler may not be much freer from slack than some of the types of hook and link couplers.

The second diagram shows the resistance of a train conpled with the link slack, and of a train with the link slack blocked out, in a haul of about 400 ft. on the easy curve immediately east of stop-post No. 3, which is at the top of a long grade. This test, to have had an exact bearing on the question of the resistance of a close coupled train on

CORRESPONDENCE.

Engine Collisions.

KANSAS CITY, MO., April 28, 1887.

EDITOR ENGINEERING NEWS:

In ENGINEERING NEWS of April 9, p. 233, in speaking of the remarkable positions taken by two locomotives after collision, it is stated that "the engines have assumed a very different position from what they would have been likely to assume, had they come together with equal velocity."

Now, as velocity is in any case simply relative to some point *assumed* as fixed; and as momentum (which is a measure of the force exerted or to be overcome) is, according to Prof. RANKINE, "the product of its mass into its velocity relatively to some point assumed as fixed;" it would appear that the resulting positions would be the same whether each engine had been approaching the other at ten miles per hour, or whether one had been stationary (relatively to the track) and approached by the other at the rate of twenty miles per hour; and the position, strength and rigidity of the parts—such as the pilot—receiving the shock would determine the resulting positions of the engines. It will be noticed that in the illustration given, the pilot of the stationary engine appears intact, while that of the other is destroyed. This I would account for by a possible difference in the material, design or elevation of the pilots (as suggested in the article referred to) than by any difference in their velocities other than in relation to each other. Yours truly,

KENNETH ALLEN.

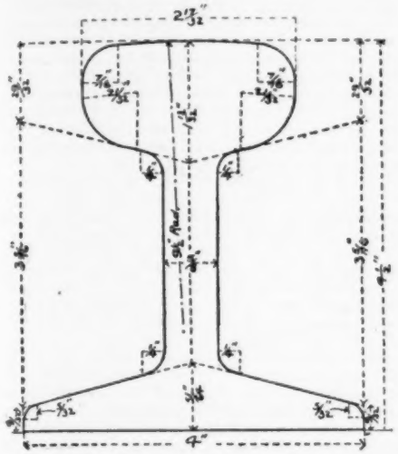
[We have commented elsewhere upon this article, which follows one to a similar effect from another correspondent.—ED. ENG. NEWS.]

Worn Rail Sections.

Engineer's Office of the P. S. V. R. R. Co.,
POTTSVILLE, Pa., April 21, 1887.

EDITOR ENGINEERING NEWS.

While running some lines in the Mt. Carbon yard of this railroad, some worn rails came under my observation, and the wear being peculiar, I took a few impressions of the ends of some of them, which I send you herewith. The rails have been in use on



Original Section of the accompanying worn rail sections. (Old Penna. R. R., Standard.)

the Pennsylvania Railroad, but just where, I have not as yet been able to ascertain. As I took the impressions carefully, I think the sections may be relied upon as being quite accurate.

Yours truly, E. WILE.

[The sections have been photographically reduced from their original full size, and certainly show a very peculiar wear, especially in the large amount of wear from the fish-plates. The rails, however, are apparently of considerable age.—ED. ENG. NEWS.]

Granite Paving Stone Wanted.

Comm. Office Department of City Works,
BROOKLYN, N. Y., May 6, 1887.

EDITOR ENGINEERING NEWS:

Will you kindly furnish me with list of firms who deal in "granite blocks" for street paving, say granite such as "Guidet" pavement.

This Department for all supplies will endeavor in every case to reach first hands and obtain bottom prices for what we may require.

Agents for quarries or persons direct, and oblige,

Yours truly, JAMES A. MURTHA,
Dept. Com'r.

[In looking over lists of dealers in granite, we find plenty who advertise for buildings and cemetery work, but none for paving stones. The most available lists are those given in our "Construction News" from week to week.—ED. ENG. NEWS.]

The Shaft Problem.

NEW YORK, May 9, 1887.

EDITOR ENGINEERING NEWS.

Referring to the problem mentioned in your issue of April 23, viz:

"What is the longest rigid line that can be passed down a shaft 4ft. wide, into a drift 8 ft. high at the bottom of the shaft?" The length of the required line may be determined by a discussion of the conditions of tangency of the curve described by the extremity of such a line in its passage down the shaft and into the drift, and is the value of R in the equation of the four-cusped hypocycloid,

$$R = (x^{\frac{2}{3}} + y^{\frac{2}{3}})^{\frac{3}{2}}, \text{ in which}$$

x = width of shaft.
y = height of drift.
R = length of longest line = 16.648 ft.

Yours truly, S. W. HOAG, JR.

An Old Treatise on Surveying.

LEECHBURG, Pa., May 6, 1887.

EDITOR ENGINEERING NEWS:

While in my father's library some few days since, my eyes fell upon as "quaint and curious volume" as it is the good fortune of one ever to see. The title page announces that it is:

JACOB MEYER'S *Geometria Practica Planimetria.*

A treatise on Land Surveying and Division, published by the book-house of JOHAN KÖNIG, Basel, Switzerland.

This book is printed in German and is, I think, the first book printed in that language, which makes a specialty of the "mysteries" of land surveying. It was written in 1663 and printed in three parts, all combined in one volume, in 1669—1691—1712 respectively.

The book is 4 ins. in width, 3 ins. in length, and 1½ ins. in thickness, and is bound in pig skin. Notwithstanding its great age it is in a good state of preservation and but for the odd binding and a tinge of yellow here and there one would hardly think it to be as old as it is.

That the afore mentioned JACOB MEYER was a gentleman of a high and unusual education for those days one needs but to be convinced by a perusal of the *vorrede* or preface.

To write so learnedly of a science so little known of but by a few in those days, Mr. MEYER'S could not content himself with the idea of giving the facts in plain German, but every now and again breaks in with a Latin or "hog-Latin" phrase or word, in which way and by which means he makes the facts of his preface doubly impress his infatuated reader, or as he puts it in his preface: "To the science loving reader."

In his preface he gives all the arguments pro and con as to whether Theory should preceed Practice or vice versa, or whether one can exist without the support of the other, etc. The most clinching arguments are given to support every assertion, and the gentleman warms up to his work in no half way manner by any means. He also makes several quotations from the "Book of Moses" as a sort of final "clincher," which leave no room for doubt whatever. Mr. MEYER was a gentleman of the highest integrity as the attention which he call to the "thievery" practised by land surveyors of those days, by making false measurements, etc., well attests.

The book is a remarkably thorough one on Mensuration, Plane Trigonometry, etc., in addition to its completness on land surveying.

Very truly, THEO. LOW.

Rolling the Sandberg Goliath Rails.

19 Great George Street, Westminster,
LONDON, April 27, 1887.

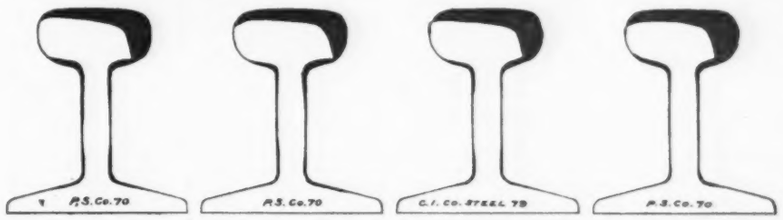
EDITOR ENGINEERING NEWS:

Responding to the fears which have been expressed in your paper as to possible difficulties in rolling extra heavy rails satisfactorily, I am happy to tell you that the rolling of the Goliath (100 lbs. per yd.) rails at Seraing was a great success, as I saw it. No accidents less than half wasters, as on little rails; no extra "personnel" despite the great weight of half a ton a rail, or one ton ingots (which, when rolled in a larger mill, will probably be 2-ton ingots, rolled into four rails, to get more work upon the steel). The fact is settled that the heavier the rail the cheaper it is made, even for 105 lbs. per yd. as is really the Belgium Goliath.

I am to have it exhibited in the American Exhibition here. I shall always be ready to give you information, as you were the first to take up my ideas about heavy rails, and we may consider the victory gained.

Yours truly,
C. P. SANDBERG.

[The information which Mr. SANDBERG here gives will tend to relieve an anxiety which many have felt by others than ourselves, that there might be special difficulties in rolling extra-heavy rails so as to have them equally solid and homogeneous. This difficulty overcome or shown not to exist, we do not see any reasonable room for doubt that 90 or 100 lb. rails are the most truly enonomical by far for trunk line traffic, or anything approaching to it.



Worn Rail Sections.

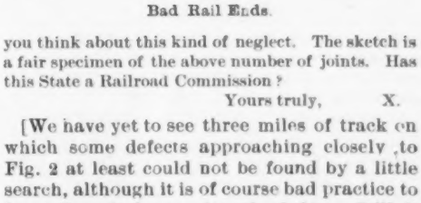
The fact is, much of our rail practice is merely a tradition from the days when traffic was far lighter, and rails far dearer. With traffic and prices as they are now, a 60 lb. or 65 lb. rail is absurdly light for Consolidation Engines from an economical point of view, not to speak of safety. ED. ENG. NEWS.]

Bad Rail Ends.

WAYNE, Ill., May 5, 1887.

EDITOR ENGINEERING NEWS:

I enclose you herewith a sketch showing the condition of some six or eight rail joints in three miles of road. At least half of these breaks are on the inside edge of the rails. The company is quite noted for its good sound track. Please let me know what



Bad Rail Ends.

you think about this kind of neglect. The sketch is a fair specimen of the above number of joints. Has this State a Railroad Commission?

Yours truly, X.

[We have yet to see three miles of track on which some defects approaching closely to Fig. 2 at least could not be found by a little search, although it is of course bad practice to leave them in for any length of time. Still, it is astonishing how long such defects will run without causing any accident. They are bad, but not so bad as a great many other things, nor as our correspondent seems to imagine. There is a railroad commission in Illinois.—ED. ENG. NEWS.]

PERSONAL.

GEORGE A. JUST, formerly with Cooper, Hewitt & Co., has accepted the position of Engineer for the Jackson Architectural Iron Works, 315 E. 28th street, New York City.

MR. PETER EMSLIE, well known as a civil engineer and for many years connected with the Lake Shore Railroad, died last week in Buffalo, aged 72 years. Mr. EMSLIE had been engineer for the New York Central and the Erie railroads besides his connection with the Lake Shore. He was appointed by Governor ROBINSON to superintend the erection of the Buffalo State Insane Asylum. He was an enthusiast on the subject of solid masonry structures on railways and designed some very fine work of this description on the Lake Shore R. R.

The Weather of the United States for the Month of April, 1887.

[As respects the elements of most interest to engineers.]
According to special returns from the Chief Signal Officer of the U. S. Army.

STATION.	Temperature. Degrees Fah.				Wind Velocity. Miles per hour.		Wind Velocity. Direction.	Precipitation. Rain and melted snow. Inches.		
	Average	Max.	Min.	Range.	Average	Max.	Max.	Total.	Heaviest in 24 hours.	No. rainy days.
Northern Cities.										
Northfield, Vt.	35.4	67.8	— 1.0	68.8	8.7	46	N	3.39	1.09	13
Portland, Me.	40.2	70.2	21.5	48.7	9.0	36	SE	4.96	1.76	13
New York City.	47.7	56.7	39.2	17.5	8.5	29	NW	3.67	1.67	12
Pittsburg, Pa.	51.3	83.8	24.0	59.8	7.2	30	SW	4.29	2.56	10
Chicago, Ill.	47.4	82.2	19.1	63.1	12.1	38	W & SW	0.46	0.18	5
Omaha, Neb.	54.5	88.0	23.4	64.6	10.2	36	N & S	0.88	0.24	14
St. Paul, Minn.	45.0	84.2	13.8	70.4	8.2	29	N & NW	3.14	1.58	11
Duluth, Minn.	38.7	79.9	6.6	73.3	7.7	35	NE	1.58	0.47	14
Bismarck, Dak.	42.8	87.3	11.8	75.5	8.9	40	NE	1.52	0.57	14
Average	44.6	77.8	17.6	60.2	8.9	35.4		2.65	1.12	11.8
Southern Cities.										
Washington City.	51.6	83.9	28.0	55.9	6.6	32	NW	3.24	1.04	14
Louisville, Ky.	56.4	87.0	30.3	56.7	8.4	34	W	7.31	3.08	9
St. Louis, Mo.	60.7	86.7	31.6	55.1	13.4	40	NW	4.36	1.87	9
Savannah, Ga.	63.7	89.0	35.5	53.5	8.7	32	E	2.06	0.90	6
Leavenworth, Kan.	57.3	87.2	26.4	60.8	9.5	29	NW	1.99	0.82	8
Jacksonville, Fla.	67.0	88.7	37.6	51.1	7.6	39	SW	4.15	1.66	7
Chattanooga, Tenn.	61.5	88.6	34.3	54.3	5.5	32	SW	3.06	2.36	6
New Orleans, La.	67.9	86.8	48.5	38.3	7.7	28	SW	1.87	1.26	6
Memphis, Tenn.	63.6	87.2	38.4	48.8	7.3	25	NW	2.34	1.22	6
Palestine, Tex.	66.0	87.6	39.9	47.7	10.4	33	NW	0.74	0.49	3
Average	61.6	87.3	35.0	52.2	8.5	32.4		3.11	1.47	7.4
Far Western Cities.										
Helena, Mont.	42.4	74.0	21.7	52.3	8.1	30	W	1.93	0.78	9
Port Angeles, W. T.	Not yet received.									
San Francisco, Cal.	54.5	78.5	43.7	34.8	10.0	32	NW	2.30	1.45	8
Salt Lake City, U.	48.6	80.7	27.1	53.6	6.8	32	S	1.87	0.61	8
Denver, Col.	48.7	82.5	20.5	62.0	9.4	47	W	2.16	1.26	13
Yuma, Ariz.	69.8	96.9	43.5	53.4	7.7	31	W	0.20	0.20	1
Santa Fè, N. M.	Not yet received.									
Average	52.8	82.5	31.3	51.2	8.4	34.3		1.69	0.86	7.8

TECHNICAL NOTES.

STEUBENVILLE, Ohio, has now tested for several years a street pavement made of fire-brick, with very satisfactory results. The brick is laid on edge on 4 in. of sand over 4 in. of gravel. The cost is said to be "83 cts per sq. yard."

PROFESSOR RANKINE gives the following as the characteristics of good bricks:—1. To be regular in shape, with plane parallel surfaces and sharp right-angled edges. 2. To give a clear ringing sound when struck. 3. When broken, to show a compact uniform structure, hard and somewhat glassy, and free from air-bubbles and cracks. 4. Not to absorb more then about one-fifteenth of their weight of water. Bricks which answer the preceding description, when set on end in a hydraulic press, should require at least 1,100 lbs. on the sq. in. to crush them, and they will sometimes bear considerably more. A small pillar of brickwork made of bricks of this quality, laid in cement, should require from 800 to 1,000 lbs. on the sq. in. to crush it. Bricks in general begin to show signs of giving way, by splintering and cracking, when under about one-half or two thirds of their crushing load. The weaker qualities of bricks may be estimated as having from one-half to two-thirds of the strength above stated. The bricks supplied to every building of importance should be carefully inspected, and the defective ones thrown away.

PAPER pipes as manufactured in Germany, are made of hemp paper, not rough felt paper, and asphalt. The mode of manufacturing them is the following: The hot paper mass is wound around a roller by machinery, and when the desired thickness has been attained, it is pressed until it gradually cools and hardens. The durability of these paper pipes is said to have been established beyond reach of doubt, while to cut the asphalted paper stuff is like cutting hard wood. The pipes are of a lava-like black, and at the first glance they look like asphalt, being smooth within and rough without. For water, gas, subterranean telegraph wires, telephone conductors, etc., the pipes are reported to serve admirably.

Dr. C. C. CARROLL, of Meadville, Pa., claims to have discovered a method by which aluminum can be cast, soldered and welded.

PUBLICATIONS RECEIVED.

The Official Railway List; a Complete Directory of the Presidents and all railway officials, including master mechanics, car-builders, car-painters and foremen of repairs, roadmasters, etc. Sixth year; 1887; Published by the Railway Purchasing Agent Co., 95 Express Building, Chicago. Price, $2.00.

This very useful publication requires little comment further than to say that with each year it is becoming more and more valuable to every one having to do with railways. We have here arranged in a handy and handsome form the name and address of every official connected with the railways of the country, corrected to April 1, 1887; including all from president to roadmasters.

Report of the Secretary of Internal Affairs on the Boundaries of the Commonwealth of Pennsylvania 1887. State Printer, Harrisburg, Pa. With an Atlas of folding Maps.

This is a voluminous and careful report of surveys and resurveys of the various boundaries of the State of Pennsylvania. Mr. J. SIMPSON AFRICA, the Secretary of Internal Affairs, has here gathered together a vast amount of most interesting historical data, from the original agreement of Lord Baltimore and the Penns, in 1760, to the agreement between the Commissioners of Pennsylvania and New York in 1886. The record includes the original field-notes of CHAS. MASON and JEREMIAH DIXON and a facsimile of the original published Map of the MASON and DIXON surveys. In the accompanying atlas are altogether 20 maps, on a large scale, showing the detail of the surveys. The historical portion begins in 1707 and continues to the final report of last year.

Scribner's Magazine, for May, contains matter interesting to engineers in two articles at least: The Development of the Steamship, by Commander F. E. CHADWICK, U. S. N., traces the rise and progress of steam navigation and the development in naval architecture from Fulton's day to our own in a thorough and yet very entertaining manner. Professor N. S. SHALER contributes a practical paper on the "Forests of North America," and discusses the subject from both an economic and scientific stand point. Another article entitled an "Ocean Graveyard" shows a curious wreck-chart recording the long list of vessels that have met shipwreck on Sable Island.

SOCIETY PROCEEDINGS.

Engineers' Club of Philadelphia.—Record of regular meeting, April 16th, 1887. President T. M. CLEEMANN in the chair; 24 members present. The Secretary presented, for Mr. EDWIN LUDLOW, "Notes on the Preparation of Anthracite Coal." Mr. LUDLOW says:

"I desire to call the attention of the members of this Club, and especially those who are Mechanical Engineers, and have the bump of inventiveness well developed, to one of the greatest needs now met with in the preparation of anthracite coal. While engineering ability and mechanical skill have done wonders during the last decade toward putting the mining and preparation of coal on a scientific basis, making it possible to ship as high as 2,600 tons of prepared coal from one breaker in a single day still in every breaker, no matter how modern it may be, one will find the chutes, through which the coal passes from the screens to the loading pockets, lined with boys from twelve to fourteen years of age, who sit there ten hours a day picking by hand the slate from the coal as it passes along. The atmosphere of this screen-room is, in many cases, so laden with fine coal dust that objects cannot be distinguished twenty feet away; and while the breathing of this coal dust does not seem to have any immediate effect on the boys' health, it undoubtedly lays the seeds for the bane of the coal region—miners' consumption. It strikes every thoughtful man, who looks down on from one hundred to two hundred boys working in a single breaker, that it is a very crude and expensive way of preparing coal.

"Various appliances have, of course, been designed, but the only really successful one, as proved by actual experience, has been the water jig. This undoubtedly removes the slate with a small percentage of waste of coal, and where the product of the mine is wet and water has to be used on the screens to affect a separation of the dirt from the coal, it is the best and most economical appliance that can be employed. But the greater part of the coal going to market comes from dry mines, where it would be a detriment to the quality of the coal, and a great expense, to use water.

"The waste water from the jig is also expensive to take care of, as in most localities it is no longer allowable to let it run, with the fine dirt it holds in solution, into the nearest creek, as the sediment will carry a long distance, and invariably deposits itself where it will do the most harm, and entail a heavy suit for damages. Enough tanks have therefore to be provided to allow all the waste water to thoroughly settle, so that the water and clum can be removed separately. Water itself, or rather the pure article, is both scarce and expensive during a part of each year throughout nearly the whole region.

"And if mine water is used, as is generally the case, the acid contained in it attacks the iron work of the jig, and makes frequent repairs necessary.

"The principle the jig works on is based on the difference in specific gravity between coal and slate. The two enter the bottom of the jig together, and by the pulsations of a large plunger in an adjoining compartment, water is forced up through the coal, lifting it, and allowing a fresh supply to come in. The coal is forced to the top and runs off with the water while the slate, owing to its great specific gravity, passes out through a separate opening in the bottom.

"Now what is needed, and what I hope some member of this Club will devise, is a dry jig, in which this separation will be affected by the use of air instead of water.

"One of the difficulties encountered in getting up such a jig is caused by the care with which coal has to be handled to prevent its chipping or breaking. It cannot be dropped on to iron or wire or to itself without producing an appreciable percentage of waste. With the the most approved rolls the loss in rebreaking any size to a smaller one amounts to from 10 to 15 per cent.

"While the difference in specific gravity between coal and slate of the same sized pieces is very great, still trouble would be experienced in any separation by an air current with flat pieces of both slate and coal, on which the action of the air would vary, according to whether it acted on the edge or the whole side.

"The man who invents a successful dry jig that will stand the test of actual trial, will undoubtably make a very handsome thing by it.

"Not to be too cumbersome a single jig should not have a greater capacity than 500 tons per day, and as the shipping capacity of the anthracite region is about 200,000 tons per day, it would take about 400 to supply the trade.

"I shall always be most happy to furnish any information, or give any assistance in my power to any one desiring to work on this matter."

Mr. J. E. CODMAN presented a description of a "Perpetual Motion Machine," which had been offered by a Western correspondent of the Philadelphia Water Department, as a means of supplying Philadelphia with water at an annual running expense of five dollars.

Kansas City Engineer's Meeting.—The Engineer's Club of Kansas City held its regular meeting May 2nd, at its club room in the Deardoff building. WM. B. KNIGHT, President, in the chair; K. ALLEN, Secretary, and 16 members and visitors present.

An official notification was received from Secretary J. B. JOHNSON of the action of the board of managers of the association of engineering societies at a meeting in Chicago April 15, admitting the Kansas City club into the association. The following names of members elected into the club were read; WM. D. JENKINS, en-

gineer in charge of the Missouri river bridge for the Chicago, Milwaukee & St. Paul Railway at Randolph; J. F. WALLACE, resident engineer of the Missouri river bridge, Santa Fé & California Railroad at Sibley; ROBERT C. PEARSONS, assistant engineer Water-Works Company, Quindaro; M. E. BOWEN, assistant engineer Kansas City Cable Railway; E. W. GRANT, resident engineer of the Chicago, Santa Fé & California Railway Company, Chicago; WM. NORRIS, chief engineer Kansas City, Chicago & Texas Railway Company; T. F. WINNE, mechanical superintendent Metropolitan Railway Company.

Mr. GALEN W. PEARSONS, chief engineer of the National Water-Works Company, read the paper of the evening, entitled, "Work with Submarine Armor."

Mr. WM. H. BREITHAUPT, consulting engineer of the firm of Breithaupt & Allen, presented lithographs of the longest continuous girder bridge yet constructed, at Lachine, Que.

Engineers' Club of St. Louis.—Meeting of May 4, 1887. Col. E. D. MEIER read a paper on "Evaporative Efficiency of Boilers," prefacing his remarks by the statement that he had been unable to complete his investigations, and asking that the present paper be considered as introductory to a more complete discussion which he hoped to be able to present later. Col. MEIER spoke of the duty expected of steam generating apparatus, and the difficulties met with in reducing the results secured in tests to a common standard for comparison. Some suggestions were made looking toward a suitable standard of comparison. The values of various grades of fuels were touched upon. The relative merits of steel and iron for boiler construction were discussed, the conclusion being that it depended wholly upon proper precautions being taken to make sure that a suitable grade of material is secured. Prof. POTTER, Prof. JOHNSON, Mr. FLAD, Mr. SEDDON and Mr. WHEELER took part in the discussion.

The president announced the Committee on Smoke Prevention as now constituted to be: W. B. POTTER, E. D. MEIER, H. B. GALE, C. F. WHITE, W. H. BRYAN and C. E. JONES. A paper by H. A. WHEELER on the "Relative Economy of Machine and Hand Drilling," was announced for the next meeting.

STATISTICS OF NEW WATER-WORKS CONSTRUCTION.

(Specially Communicated.)

CONTINUED FROM PAGE 303.

Baraboo, Wis.—The franchise is owned by Moffett, Hodgkins & Clarke, of Watertown, N. Y., and the works are operated by the Baraboo Water Works Co., of which J. F. MOFFETT is President, and CHAS. T. MOFFETT, Secretary. J. W. READE is Superintendent. The franchise is for 30 years, and provides for 80 hydrants at an annual rental of $3,300. Construction was commenced Nov. 1, 1886, and the works were accepted March 12, 1887. The water is obtained from springs, 41½° hard, and pumped from a well consisting of an iron caisson 20 ft. diameter; it is pumped by water through a duplex power pump, 11 ins. by 10 ins. stroke, to the top of the tank, 250 ft. The works were designed and contracted for by Moffett, Hodgkins & Clarke, E. G. FERRIS being the Constructing Engineer. The masonry and foundations were built by Reuben Wilby, and the buildings by Geo. Capenor. The pumping machinery was supplied by the Deane Steam Pump Co., Holyoke, Mass.; the pipe and specials by the Warren Foundry & Machine Co., Phillipsburg, N. J., and the valves and hydrants by the Ludlow Valve Co., Troy, N. Y. The trenching and pipe laying were done by day labor. The tower reservoir was built by Riter & Conley, Pittsburg, Pa.; the tank is 52 ft. high and 30 ft. diameter; the bottom is 130 ft. above the town. The population in 1887 is estimated at 6,000.

Mr. FERRIS, the engineer of the works, writes us as follows: "The work was begun Nov. 1 and continued through the winter. Thermometer most of time below zero and to —46°. Ground frozen, Nov. 24, 2 ft., Jan. 24, average 4½ ft., in places to 8 ft. Small holes 5 ft. × 2½ ft. were cut through frost, and tunnels 6 ft. to 15 ft. long run under the frost, and pipe laid, and covered 6 ft. to 9 ft. What I want to call attention to is, that 7 miles of pipes laid in this extremely cold weather are almost perfectly tight. With a pressure of 180 ft. head and shut off from pump in one week (7 days) the water did not fall 2 in. in the tank. As we have but few consumers yet we do not pump at night, there is not leakage enough in one night to read it on the gauge. I had noticed before that pipes laid in very hot weather were almost sure to leak at the joints, more or less. In a long suction pipe (2,300 ft.) laid in very hot weather, last year, almost every joint leaked under 55 lbs. pressure, and had to be recalked although extra pains were taken when laid. Will some one who has noticed the same thing explain how expansion should make tight joints, and contraction loose or leaking ones?"

Genesco, N. Y.—The works are under the control of the Board of Water Commissioners, of which W. A. WADSWORTH is President, and S. H. BLYTH, Secretary. Construction was commenced May 1, 1887, and is expected to be completed by September. The contractors for masonry and foundations, buildings, trenching and pipe laying, and reservoir were Coon & Mooney, Kingston, Pa.; for pumping machinery, Holly Manufacturing Co., Lockport, N. Y.; for pipe and specials, Sayre Pipe Foundry, Sayre, Pa.; for valves, Rensselaer Manfacturing Co.; Troy, N. Y., and for hydrants, Ludlow Valve Co., Troy, N. Y. The works were designed by J. NELSON TUBBS, Chief Engineer, Rochester Water Works; and JOHN YOUNG, Geneseo, is Constructing Engineer. The prices paid for trenching are 12½ cts. for 5 ft. deep, and 11½ cts. for 4½ ft. deep; for laying 4, 6, 8 and 10-in. pipe, 6, 7¼, 8½ and 9½ cts. The population in 1887 is estimated at 2,300.

Lincoln, Neb.—The works are owned by the city, and all work is done by the city. L. L. LYMAN is Superintendent. During 1886 the city laid 4,760 ft. of new mains; the price paid for trenching was 75 cts. per section of 12 ft., 5½ ft. deep. The stand-pipe is 87 ft. high. The present population is estimated at 40,000.

Kingston, Mass.—The works are owned by the town, and managed by a Board of Water Commissioners. MELVIN C. FRENCH is Superintendent. The works were designed by A. H. HOWLAND, C. E., of Boston; W. C. BOYCE, of Worcester, was Constructing Engineer. Work was commenced April 12, 1886 and completed August 10. The masonry, foundations, buildings and reservoir were built by the Water Commissioners; the pumping machinery was furnished by the Geo. F. Blake Manufacturing Co.; the pipe and specials by the McNeal Pipe & Foundry Co., and the valves and hydrants by the Coffin Valve Co. The trenching and pipe laying was done by Thos. F. Maney & Co., at the following prices per ft.; 4-in., 14 cts.; 6-in., 15 cts.; 8-in., 20 cts. The reservoir is 181 ft. above pump to high water mark. The present population is estimated at 1,570.

(TO BE CONTINUED.)

NOTE.—The above statistics of new construction are sent in response to special inquiries sent out by us to contractors, superintendents, engineers and others having to do with new works. We have a special blank for this service, and will be pleased to forward one or more on application. We invite co-operation in this special subject.

TRADE NOTES.

PHOSPHOR-BRONZE SMELTING CO.—This company, of 512 Arch street, Philadelphia, announces that their new and enlarged foundry is now in successful operation with full equipment. They are the sole manufacturers of this phosphor-bronze in the United States; it is extensively used in car and locomotive bearings, heavy gearing and hydraulic, marine, mill, mining and engine castings. The prices per pound range, with purpose intended, from 25 to 27 cts., with special prices on detailed application.

CONSTRUCTION NEWS.

Water.

Attention is called to our advertisement of back Nos. of ENGINEERING NEWS for 1886. The "News of the Week" columns alone form a very complete record of contract work in every part of the country. *Absolutely every copy* will be disposed of as rapidly as possible, and as soon as the demand ceases the remaining stock will be sold to the junk dealers. It is now or never for those who want any of these numbers.

Smith's Falls, Ont.—When the Canadian Pacific R. R. established its shops at Smith's Falls, Capt. FOSTER laid a line of pipe to supply the locomotives with water. The town has just rented three hydrants on this line for $140 per annum, and the pipe will probably be extended.

The Hyatt Filter.—The Newark Filtering Co. has made a proposition to put in a plant at the Fairmount pumping station, Philadelphia, to filter 40,000,000 galls. per day, at a cost of $600,000.——The Winona Paper Co., at Holyoke, Mass., has put in a Hyatt filtering plant of about 1,500,000 galls. daily capacity.

The New England Water Works Association will hold its annual meeting at Manchester, N. H., June 15, 16, 17. The programme will be published later.

Mobile, Ala.—A petition for an injunction against the Bienville Water Supply Co. in which S. R. BULLOCK & Co., of New York, are interested, has been filed by L. STEIN, of the Mobile City Water Works, who claims the exclusive right to supply the city with water from Three Mile creek. The Bienville Water Supply Co. will obtain its supply from Eight Mile or Clear creek; this company has laid several miles of pipe and is pushing on its works. The matter will be fought out in the courts.

Belleville, Mo.—The City Council passed a resolution on May 2 deciding not to use the hydrants of the Belleville Water Co. There are 100 hydrants in the city for which an annual rental of $7,500 has been paid; the Council concluded that this rental was too high, but the water company claimed that it could not afford to charge less. The company has laid about 11 miles of main, constructed a reservoir and erected plant; the pressure was available for fire purposes. Now the city will have to rely on the steam fire engines and the cisterns. The insurance rates on factories will be raised.

Eureka, Cal.—The city has an excellent system of water-works, but considerable extensions are needed. The Ricks Water Works have 6½ miles of mains in the city, which furnish 375 services; some districts are to be relaid with 10-in. pipe. The supply is drawn from a dug well 22 ft. square and 47 ft. deep, and two 10-in. artesian wells 100 ft. and 293 ft. deep, another 6-in. well is being driven; it is pumped by a 25 H. P. engine driving 3 Knowles pumps. The present capacity of the works is 30,000 galls. per hour, and the monthly consumption for this year has been as follows: 2,693,560, 2,679,976, 3,293,544 and (approximate) 4,500,000 galls. H. L. RICKS is Superintendent. There are also the City Water Works, established in 1873 by JOHN VANCE. A supply will also be furnished by F. A. WEAVER.

Amsterdam, N. Y.—The Superintendent of Water-Works, A. H. DEGRAFF, has presented his sixth annual report to the Water Commissioners. The quality of the water is excellent and no bad taste or odor has been experienced. An increased supply is needed and two plans are proposed, one to bring water from Perth Center creek to Bunn creek, the other to build a large storage reservoir in Bunn creek above the distributing reservoir; the latter plan is recommended. During the year 280 ft. of 8-in. pipe; 1,906 ft. of 6-in. and 864 ft. of 4-in. have been laid, total, 3,030 ft.; 12 hydrants and seven gates have been set. The average cost of the new work was 95 cts. per lin. ft. The system now comprises 76,089 ft. of pipe, 130 hydrants and 196 gates. The Superintendent recommends the purchase of land for a storage reservoir; extensions of the mains, and the establishment of meters at hotels, boarding houses and stables.

Kansas City, Mo.—The wrought iron portion of the river syphon at Quindaro, Kan., where the low service works for the supply of Kansas City are being built, was successfully joined to the inlet caisson in the river, on April 30. This part of the syphon is 3½ ft. internal diameter, 75 ft. long, and weighs 9 tons. The caissons having been prepared for its reception it was lowered to place, the outer end being 7 ft. below extreme low water mark; the inner end, by the inclination of the pipe, lying partly on the bottom, and partly in excavation, reaching above low water mark to firm ground, where it is joined by a cast-iron pipe reaching to the works, some 650 ft. The engines are being placed, and engineer PEARSONS claims that they will be the finest low service engines in the country. At Kansas Point the engines for the high service addition to the works are in a similar state of forwardness and in a few weeks the source of water supply for the whole works will be changed from the Kansas to the Missouri river.

Sandusky, O.—The Superintendent has submitted his eleventh annual report to the Trustees of the Water Works. The water is reported to be good, though occasionally muddy. The plan for a filtering basin on Cedar Point is not thought feasible. During the year 9,293 ft. of main have been laid, and 6 hydrants, 10 gates and 40 service taps set. The system now comprises 23.7 miles of pipe, 155 hydrants, 161 gates, 1,544 service taps and 52 meters (Crown, Empire and Worthington). Contracts for trenching were let to Mike Cassidy at 4¾ cts. per ft., McKean & Callan at 6 cts. for earth and 15 cts. for rock, Price & Johnston at 22½ cts. per ft., and Price & Higgins at 9¼ cts. The total consumption was 637,691,000 galls., a reduction on that of the previous year; this reduction is due to the putting in of meters; the consumption for 1884 was 803,500,000 and for 1885, 710,614,000 galls.

The works were built in 1876 and are owned by the city; the supply is drawn from Sandusky bay and pumped to a stand-pipe. The population is estimated at 23,000, 16,000 on the lines of pipe and 11,000 supplied. The mains are of cast-iron, 3 to 20-ins. diameter; the services are of cast-iron, wrought-iron and lead, from ¾-in. to 6-ins. diam. CHAS. A. JUDSON is Superintendent.

Evansville Ind.—The works were built by the city at a cost of $300,000, and have been improved at an additional cost of $180,000. There are 38 miles of mains, with 1,549 consumers, and the daily capacity of the Holly pumping engines is 5,000,000 galls. There are 257 hydrants. The direct pressure system is employed.

Lebanon, N. H.—On May 10 a very destructive fire occurred, burning an area of 10 acres, on both sides of the Mascoma river. The total loss is estimated at not less than $300,000, with $110,000 insurance. The failure of the water power pump, which was depended upon for emergencies, necessitated calls for help from Enfield, Hanover and Concord. Within the last two months the town has contracted for a system of waterworks, to cost $40,000.

New Water Works.—Milton, Ont. A local contractor has offered to put in the water-works for $16,000.——Camden, Me. Work has been commenced by the Camden & Rockland Water Co.——Camden, N. J. Bonds for $100,000 will be issued for water-works.——Warren, O. The works are completed; there are 12 miles of mains.——Wichita, Kan. The new works with nine miles of mains will cost $350,000.——Natchez, Miss. The company is having difficulty in locating the source of supply: it will probably be drawn from St. Catharines creek.——Valley Falls, Kan. Address C. E. LORD.——Pittsfield, Ill. Address SCOTT WIKE, President of the Water Board.

Lancaster City, Pa.—The reports of Mr. J. J. R. CROES, of New York, and Mr. CHAS. G. DARRACH, of Philadelphia, upon the improvement of the water and sewerage systems of this city were submitted to Councils on May 4. Mr. CROES found it essential to the health of the city to remove the source of water supply from its present situation where it is now liable to sewage contamination. He thought the intercepting sewer proposed was impracticable and presented several alternative plans for an improved supply; one bringing the water from Ranck's dam, now owned by the city, and 2¼ miles above the present works, by a 36-in. wrought-iron pipe, thus utilizing the present pumping plant; this plan would cost about $73,275. The second plan proposed the erection of a new dam, moving the pumping station to Ranck's dam and adding additional steam machinery to replace the work now done by water power, and a new pumping-main; the estimated cost is $133,800. These two estimates show that the present water-power is worth about $40,000 to the city as compared with pumping by steam alone. Mr. CROES did not recommend storage reservoirs as a means of supplying cleaner water, as a properly constructed basin of this character would cost $75,000 exclusive of land; he thought some form of mechanical filter would be cheaper and quite as satisfactory in its working. As to the scheme suggested of going 6 miles above the city for water, Mr. CROES thought nothing would be gained in the purity of the water supply, about 30 sq. miles of water-shed would be lost and these works would cost $300,000. He recommended the first named scheme above, as regards economy of construction and operation, with mechanical filtration and pumping into a stand pipe.

Mr. DARRACH in his report did not enter into details, but practically recommended the removal of the pumping station as cheaper and better than any attempt at improving the condition of the supply by intercepting the sewage. Both Mr. CROES and Mr. DARRACH said that complete surveys would have to be made before any definite plans could be adopted. According to the Lancaster *New Era*, the report of Mr. CROES has effectually exploded some pet theories of the councilmanic experts of that city and has narrowed the various plans proposed down to the two commonsense suggestions made by him.

Plainfield, N. J.—The following are the summaries of the estimates for a water supply and a sewerage system, accompanying the report of C. PH. BASSETT, C. E., submitted to the Common Council, May 10. *Water Supply.* (A) Supply from wells, pumped to stand-pipe; Distribution, wells, $95,445; boilers, pump, engine house, stand-pipe, etc., $20,000; engineering and contingencies, 10 per cent., $11,545; total, $126,990. (B) Supply from Green brook, by gravity; Distribution, $95,445; dam, land damage, etc., and 16-in. conduit, $94,000; engineering and contingencies, 10 per cent., $18,945; total, $208,390. (C) Supply from Stony brook, by gravity; Distribution, $95,445; dam, land damage, etc., and 10-in. conduit, $53,000; engineering and contingencies, 10 per cent., $14,845; total, $163,290. The distribution system in each plan comprises 19 miles of pipe (10 miles of 6-in., 5⅛ of 8-in. and 3⅛ of 12-in.), valves and hydrants.

Sewerage.—The "separate" system is recommended; the plans provide for 17 miles of sewers (8-in. to 20-in.) with flush tanks, manholes, etc. (A) Disposal on 30 acres of land in the western part of the city; Sewer, flush tanks, manholes, etc., $83,290; preparation of land, and outfall sewer, exclusive of cost of land, $25,000; engineering and contingencies, 10 per cent., $10,800; total, $119,090. (B) Sewers, flush tanks, manholes, etc., $83,290; outfall sewer to Raritan river at Bound Brook, 5 miles, 75,000; engineering and contingencies, 10 per cent., $15,800; total, $174,090. Land disposal is recommended; chemical precipitation to be added when needed, to supplement land treatment. R. HERING, Consulting Engineer concurs in Mr. Bassett's report.

Water Companies.—The Drownville Water Co. has been incorporated to supply Drownville, Annawomscutt and the vicinity. Capital stock, $10,000.——The Mechanicstown Water Co. has been incorporated at Mechanicstown, Md. President, VAN B. OSLER; Secretary, S. M. BIRELY. Capital stock, $10,000.——The Johnson City Water Works & Electric Light Co. has been incorporated at Johnson City, Tenn. President, C. K. MCCALLUM.——The Cullman Water Co. has been incorporated at Cullman, Ala. Secretary, J. H. KARTER.——At Eden, Ala., a water company is being organized.——The Connersville Fuel, Gas & Water Co. has been incorporated at Connersville, Ind., by JOHN B. MCFARLAND, and others. Capital stock, $3,500.——The Park Point Gas & Water Co. has been incorporated at Park Point, Minn., by ROSWELL H. PALMER, and others. Capital stock, $150,000.——The Iowa Water Co. has been organized at Ottumwa, Ia. Capital stock, $750,000.——The Stevens Point Water Co. has been incorporated at Stevens Point, Wis., by H. CURRAN and D. LLOYD, of that place; and W. H. FRITCHMAN, of New York City. Capital stock, $175,000.——The Skowhegan Water Co., Skowhegan, Me., has engaged an engineer to make the surveys for the new works.——The Presque Isle Water Co., Presque Isle, Me., has been organized: President, A. W. FORBES; Secretary and Treasurer, B. C. MUDGE. The supply is to be taken from Kennedy brook and work will be pushed rapidly.

Proposals Open.

Riprap Stone.—From 8,000 to 10,000 cu. yds. for railroad embankment along the river at Fort Madison. MCARTHUR BROS., Keokuk, Ia.

Well Boring.—A 6 or 8-in. well, from 600 to 1,000 ft. deep. LEBANON WATER WORKS CO., Lebanon, Mo.

Sewer Material.—Salt glazed pipe, 1,200 ft. of 15-in. straight; 450 ft. of 15 x 6-in. branches, 7,200 ft. of 12-in. straight, 2,850 ft. of 12 x 6 in. branches, 100 ft. of 8-in. curved pipes, 50 12-in. bends, 100 8-in. ½ bends, 50 8-in. ¼ bends; 1,600 ft., or 800 pieces, 8-in. invert blocks; 30 sets side catch-basin stones, 50 flagstones, 5 ft. by 5 ft. by 4 ins.; 50 trap stones, 2½ ft. by 10 ins. by 2 ins.; 50 extra inlet stones, 2½ ft. by 14 ins. by 2 to 4 ins.; 70 Croes' traps (60 10-in. and 10 14-in. plates), 50 catch-basin covers, 150 manhole frames, 600 manhole steps. THE BOARD OF PUBLIC WORKS, Providence, R. I. May 16.

Sewer.—Egg-shaped brick sewer, 3 ft. 6 ins. by 2 ft. 10 ins., vitrified clay inverts, manholes, catch-basins, etc. W. J. FLANIGAN, City Clerk, Binghamton, N. Y. May 17.

Sewers.—Terra-cotta pipe sewers, 12 to 24 ins. diameter, also brick and concrete sewers. WM. LUDLOW, Engineer Commissioner, Washington, D. C. May 18.

Iron Joists.—For the government printing bureau at Ottawa. A. GOBEIL, Secretary, Department of Public Works, Ottawa, Canada. May 18.

Stone.—About 5,000 cu. yds. of stone ballast, hard rock; 4,000 cu. yds. crushed stone, passed through a 2½-in. screen. JOHN W. MCDONALD, Superintendent of Streets, Boston, Mass. May 18.

Fire Plugs and Stop Valves.—About 150 plugs and 12 8-in. valves. HENRY FLAD, President, Board of Public Improvements, St. Louis, Mo. May 20.

Macadam.—HENRY FLAD (*as above*). May 20.

Dumping Board and Approach.—About 9,200 cu. ft. of round log crib work, including stone filling; 28,522 ft. B. M. yellow pine timber and plank; 14 piles, 28 to 35 ft. long; mooring posts, fender-piles, iron spikes, bolts, washers, etc. THE DOCKS COMMISSIONERS, Department of Docks, Pier A, North river, New York City. May 20.

Concrete Foundation.—For post office and court house building. ALPHEUS GAY, Superintendent of Construction, Manchester, N. H. May 21.

Sewer.—Cylindrical brick sewer, 2 ft. diameter, 4-in. shell. Plans and Specifications at the office of the City Engineer. G. H. COLE, City Clerk, Toledo, O. May 23.

Sewers and Paving.—Brick and pipe sewers, manholes, basins, concrete, excavation, etc., also 4,375 sq. yds. trap block paving. THE PARK COMMISSIONERS, Department of Public Parks, 49-51 Chambers street, New York City. May 25.

Regulating, Grading and Paving.—Granite block and trap block paving. JOHN NEWTON, Commissioner of Public Works, Department of Public Works, 31 Chambers street, New York, City. May 26.

Stone Screenings, Gravel, Concrete Floor, Foundations, Sewer and Tunnel at 97th Street, and Laying Water Mains.—JOHN NEWTON (*as above*) May 26

Supplies.—Engineer's supplies, tools, bricks, cement, lumber, etc. Major W. S. STANTON, U. S. Lighthouse Engineer (1st and 2nd Districts), Post Office Building, Boston, Mass. May 28.

Lathes.—Two instrument makers' lathes. THE SUPERINTENDENT, U. S. Coast & Geodetic Survey Office, Washington, D. C. June 1.

Sewer Pipe.—For Avondale, O.; 2,100 ft. of 21 in. 1,400 ft. of 18-in., 800 ft. of 15-in. Plans and specifications at the office of A. S. HOBBY, C. E., Johnson Building, Cincinnati, O. W. ELLWOOD WYNNE, Sinton Building, Cincinnati, O. June 2.

Dredging.—West channel of Saginaw river, along West Bay City, Mich. Lieut. Col. O. M. POE, U. S. Engineer Office, Detroit, Mich. June 2.

Stone Sidewalk.—About 30,000 sq. ft. Plans and specifications prepared by JAS. WINANS, C. E. THE TRUSTEES OF THE TOLEDO ASYLUM FOR THE INSANE, Toledo Law Building, Toledo, O. June 4.

Contracting.

Timber Work.—The contract for the timber work on the Chicago, Madison & Northern R. R., now being built from Chicago to Madison, has been awarded to A. F. Chapman & Co., of New York. The contract comprises about 3 000,000 ft. of timber and 75,000 ft. of piling. Their headquarters are at Rockford, Ill.

Street Material.—The following contracts were awarded May 9 by the Street Committee, Lancaster, Pa.: Laying crossing stone, the city furnishing all material, T. G. Bach, 5 cts. per ft.; laying gutters, the city to furnish all material, T. G. Bach, 2¼ cts. per ft.: Belgian blocks, R. S. Oster & Bro., Port Deposit blocks, $1.74 per sq. yd.; crossing stone, R. S. Oster & Bro., Port Deposit stone, 73¼ cts per ft; brick, Peter Ziegler, $6.25 per 1,000 at the yard and $6.75 per 1,000 delivered. No satisfactory bids were received for sand, backing stone and broken stone and action was deferred to the next meeting, on May 23.

Dredging.—The only proposal received May 9 by the Commissioner of City Works, Brooklyn, N. Y., for dredging in Gowanus canal at Hamilton avenue bridge, was from James Du Bois, $1,000 for work complete.

The following proposals for dredging in the East river at piers 19, 43, and 44 and bulkhead between piers 43, 44, were opened May 11 at the Department of Docks, New York City: W. M. Tebo, 23 cts. per cu. yd.; Morris & Cuming Dredging Co., 23½ cts.

Life Saving Stations.—The following proposals for the construction of a life saving station at Cape Lookout, N. C., were opened April 30 by S. I. KIMBALL, General Superintendent, U. S. Life Saving Service, Washington, D. C.: H. A. Tolbert, Barnegat, N. J., $7,970; Thomas G. Locke, Wilmington, Del., $5,250; D. S. Kramer & Sons, Elizabeth City, N. C., $5,680.

The following proposals were opened May 10, by S. I. KIMBALL, General Superintendent U. S. Life Saving Service, Washington, D. C.: For station at Bond's, N. J.; Sherman & Hand, Beach Haven, N. J., $5,300; Francis H. Smith, New York City, $5,300; A. M. Cox, Barnegat, N. J., $4,741; S. H. Morrison, Camden, N. J., $4,865.——For station at Jerry's point, N. H., Francis H. Smith, New York City, $5,490; A. J. Wing & Son, Oldtown, Me., $5,800; Jordan & Bond, Auburn, Me., $5,850; A. F. Blossom, New Bedford, Mass., $7,200.

Sewer Construction.—An immense amount of sewer work for San Diego, Cal., is advertised in the San Francisco papers. Proposals are invited for the following work: Sewer pipe, slip glazed or salt glazed vitrified pipe, 6-in., 150,000 ft.; 8-in., 20,000; 10-in., 4,800; 12-in., 1,500; 15-in., 3,000; 18 in., 1,000; 24-in., 6,750; specials and Y-branches, not to exceed 10,000. May 20.——Sewer trenching and filling; 20,000 ft. May 20.——Earth filling; 5,000 cu. yds. clay loam or hard pan and gravel within sheeting of reservoir, 6,000 cu. yds. of harbor sand or other earth, 1,500 cu. yds. of clay loam or hard pan and gravel over foundation. May 27.——Creosoted timber; white pine, southern pine or redwood lumber; 300 sq. sticks, 20 ft. long, 10 × 10 ins., 43,800 ft. B. M., 3-in. planks, 76,000 ft. B. M.; joists 3 × 12 ins., 11,250 ft. B. M., 3-in. planks, 36,000 ft. B. M. May 27.——Woodwork construction for sewage reservoir, piling and planking. May 27.——Iron bolts, nuts and washers; 1,250 bolts and nuts, 1¼ ins. long, ¾-in.; 2,500 washers. May 27.——Cast-iron pipe, 1,100 ft. of 24-in. and 600 ft. of 30-in. bell and spigot pipe. May 7.——Laying iron pipe; 24-in. from beach to reservoir in harbor, 30-in. to deep water in the channel. May 27.——Manholes; 27 manholes, brick and cement, iron covers, average depth 7½ ft. June 3.——Flush tanks; 116 flush tanks, brick and cement, circular, iron rings and covers and appurtenances, June 3.——All work to be done under the direction of the Resident Engineer of Sewerage. M. D. HAMILTON, President, Board of Trustees, San Diego, Cal. (Copies of the full newspaper advertisements and specifications may be seen at the office of ENGINEERING NEWS.)

Pipe, Castings, Etc.—Proposals for pipe and other materials for Willett's Point, N. Y., were opened May 2, by Lieut. Col. HENRY C. HODGES, New York City. The lowest bid for terra cotta was from the Manhattan Pottery, Drain Pipe & Terra Cotta Works, New York, 8-in. pipe, 45 cts., $192.38; 6-in. pipe, 30 cts., $541.50; 6 x 4 in. Y-branches, $1.25, $19.24; total, $753.12.——The lowest bid for iron pipe was from M. J. Drummond, New York; 8-in., $36 per ton; 6 in., $37; 4-in., $38; castings, 3 cts. per pound. (This bid stated that the pipe would be cast hub end up; the specification, however, calls for its being cast with the hub end down.)——The lowest bid for fire

hydrants was from the Colwell Lead Co., New York, at $24.25 each.

Railroad Work.—The Megantic R. R. Co. is in want of 500 men at $1.50 per day. An office has been opened at Exchange street, Portland, Me.

The Georgia Construction & Investment Co. has been incorporated at Augusta, Ga., to build railroads, etc. President, ROBERT P. SIBLEY. Capital stock, $100,000, with power to increase to $1,000,000.

Laying Water Mains.—At Fort Worth, Tex., the following proposals were received for laying pipe: R. C. Stirrir, 19¾ cts. per ft.; A. Okander, 34 cts. Contract awarded to R. C. Stirrir.

Sewers at Newark.—Contracts for sewers have been awarded to James Conway. A considerable number of others are to be built. Two of the pumps at the pumping station of the intercepting sewer were started May 3; the other two will be started about June.

Heating Apparatus.—At St. Paul, Minn., the contract for the ventilating and steam heating apparatus for 3 school buildings has been awarded to Holland & Thompson at $7,665, $7,076, and $5,254, total, $19,995.

Street Roller and Sweepers.—At Pittsburg, Pa., the contract for a 10-ton steam roller has been awarded to R. C. Pasteur at $5,000. The contract for two street-sweeping machines was awarded to Wm. Oeastel at $300.

Pipe Laying.—Attention is called to the advertisement for proposals for laying 62,000 ft. of 6, 8, 10, 12, 16 and 18-in. cast-iron pipe at Sheboygan, Wis. Proposals will be received by W. S. Kuhn, Muncie, Ind., up to May 24.

City Work.—At Portland, Me., the appropriations for the year include the following: drains and sewers, $15,000; harbor, $300; streets, sidewalks and bridges, $62,000; water and hydrants, $7,500; Back Bay sewer and works, $7,500; marginal way on Back Bay, $13,000.

Sand and Cobble Stone.—The following proposals for supplying sand and cobble stone for the current year were opened May 6 by GEO. RICARD CONNER, Commissioner of City Works, Brooklyn, N. Y.: Edward Dowling; sand, $1.49 per cu. yd.; cobble stone, $1.65 per cu. yd. Edward Freel, $1.35, $1.50. Charles Hart, $1.29, $1.43.

Cast Iron Pipe in Iowa.—Standard cast-iron pipe has been successfully made at the Williams Foundry, Cedar Rapids, Ia., and stood a test of 250 pounds per sq. in. without fracture or leak. A new cupola has been erected and every convenience provided for the manufacture of water and soil pipe. This is the first made in Iowa.

Water Pipe.—The contract for 2,176 ft. of 6-in. cast-iron water mains, one 6-in. cut-off and three hydrants, including connections and laying, was awarded May 2 by the Board of Water-Works Trustees, Union City, Ind., to Snyder & Williams, of Dayton, O., for $1,997 complete.

Gas Well.—The Natural Gas Co., of Vincennes, Ind., has awarded the contract for sinking a well to Kinsey & Thompson. They will drive 1,200 ft., furnishing 350 ft. of casing, for $1,500; for the next 300 ft., $1.25 per ft., and for the next 500 ft., $1.50 per ft.

Curbing, Gravel and Stone.—The following contracts were recently awarded by the Department of Public Parks, New York City: Curbing at Coenties Slip; A. E. Moran, $1.98 per ft., $1,386. Roa Hook gravel; Brown & Fleming, $1.65 per cu. yd., $8,250. Broken trap-rock stone and trap-rock screenings; Brown & Fleming; $2.35¼ per cu. yd., $18,840.

Light Station.—The following proposals for rebuilding the keeper's dwelling at the Tchefuncte river light station, La., were opened May 2 by Maj. W. H. HEUER, U. S. Light House Engineer (8th District), New Orleans, La.: John H. Gardner, New Orleans, $3,133; Stephen John Memory, New Orleans, $3,500; William Lawton Campbell, Mobile, Fla., $3,740; Andrew Downey, New Orleans, $4,017.

Street Paving.—The following proposals were opened May 2 at Columbus, O.; Naghten street; N. B. Abbott: (Medina, 1st class) corner blocks, $1.50; 5-in. Berea curb, 37 cts.; grout filling, $3.80 per sq. yd.; tar filling, $3.95 per sq. yd.; total, $8,801. (Medina, 2nd class) $1.50, 37 cts., $3.10, $3.25, $7,331. (Greenfield limestone) $1.50, 37 cts., $3.20, $3.35, $7,541.——Murphy & Bowen; (Greenfield) $1.90, 38 cts., $3.18, $3.28, $7,409. (Ligonier) $1.90, 38 cts., $3.88, $3.98, $8,669.——Thos. McDonald; (Medina) no bid, 40 cts., $3.75, $3.75, $8,415.

Front street; N. B. Abbott: (Medina, 1st class) corner blocks, $1.50; 5-in. Berea curb, 37 cts.; grout filling, $3.60 per sq. yd.; tar filling, $3.70 per sq. yd.; total, $71,652. (Medina, 2nd class) $1.50, 37 cts., $2.84, $2.99, $58,417. (Greenfield stone) $1.50, 37 cts., $2.95, $3.10, $60,468. (West Virginia fire brick) $1.50, 37 cts., $2.28, $2.35, $46,488. (Hard burned brick) $1.50, 37 cts., $1.98, $2.05, $40,896.——Murphy & Bower; (Greenfield stone) $1.88, 37 cts., $3.03, $3.03, $59,186. (Hayden block) $1.88, 37 cts., $2.71, $2.71, $53,222.——Hanley & Reese (Medina) no bid, 40 cts., $4.20, $4.20, $72,020.

Turntable.—The Atchison, Topeka & Santa Fé R. R. Co. has placed an order with Hetherington & Berner for a 60 ft. iron turntable, for the Chicago division.

Street Cleaning.—The lowest bid for street cleaning or 3 years in Brooklyn, N. Y., opened May 9, was from Herman Clark, New York; cleaning streets, $19.90 per mile for each year; removing ashes, $130,000, $125,000, $120,000. Estimating at 6,000 miles per year, the bid for the present year will amount to about $250,000.

Asphalt Paving.—The only proposal received May 9 by JOHN W. MCDONALD, Superintendent of Streets, Boston, Mass., for resurfacing Columbus avenue, was from the Barber Asphalt Paving Co., New York, at $2.50 per sq. yd. The price was for removing the present surface to the foundation, resurfacing with Trinidad asphalt 2½ ins. thick (after compression), and keeping in repair for 5 years.

Trenching.—No proposals were received by the Board of Water Commissioners, Yonkers, N. Y., for the small amount of trenching for mains, advertised for May 5. This was partly due to many of the local contractors being busy at this time of the year, and partly to a mistake as to time.

Viaduct.—The contract for a wrought-iron viaduct over the railroad tracks at Sixth street, Atchison, Kan., has been awarded to the Wrought Iron Bridge Co., Canton, O., (agent, J. W. Hoover, Kansas City, Mo.); the contract price was $13,600. FRED. GIDDINGS is City Engineer.

Electric Railway.—Two bids were received by the Borough Commissioners, Asbury Park, N. J., for the franchise for an electric railway. Henry S. Iselin and S. T. Dunham bid $2,300 per year for 10 years or $3,000 per year for 20 years. The Asbury Park Electric Railway Co. bid 5 per cent. of the gross receipts, provided they made it. The Iselin and Dunham bid will be accepted; it is for the Daft system.

Harbor Work.—At San Francisco, Cal., the Harbor Commissioners have awarded contracts to John Kelsoe and Owen McCue for rock and earth filling at the seawall for 15 cts. per cu. yd.——A large chain dredge, on the English plan, is at work near Redwood City, Cal., on San Francisco bay. The dredge was built by the Fulton Iron Works, San Francisco, at a cost of $50,000, and is said to include several new ideas in dredge construction.

Construction Material.—The District Commissioners, Washington, D. C., have awarded contracts as follows: Blue stone curb; Acker & Co., straight, 78¾ cts. per ft.; circular, $1.05. Granite curb, Maine Granite Paving Co., straight, 95 cts., circular, $1.40. Paving bricks; Washington Brick Machine Co.: $9.23 per 1,000. Granite paving blocks, Virginia State Granite Co., $40.85 per 1,000. Asphalt block and tile; Hastings Paving Co., $71 and $60 per 1,000. Dressing old curb; Gustav Creany, 20 cts. per ft. (The full list of bids was given on page 291).

River Improvement.—The following proposals for stone for lock No. 6, Kentucky river, Ky., were opened May 2 by Major JAMES C. POST, U. S. Engineer Office, Cincinnati, O.: John Keigwin, cut stone (dressed face) $9.50 per cu. yd.; (quarry face) $8.50; squared stone, $7 per cu. yd.; backing stone, $5.50 per cu. yd.; special stone, $18 per cu. yd.; coping, $17 per cu. yd.; total, $82,831. O. Brien & Co., $10.75, $9, $6.50, $5.50, $17.60, $16.50, $84,731.20. T. P. Shanks, $11.50, $10.50, $7.50, $6, $20, $20, $94,571. I. V. Hoag, Jr., $14, $12, $7, $6, $20, $20, $100,952. The contract has been awarded to J. Keigwin.

Street Grading.—At Youngstown, O., the following proposals, in three sections, were opened recently by J. M. RENO, City Engineer: Evan J. Davis, $1,017.18, $1,442.90, $2,460.08; Richard Lawlor, $1,017.18, $1,405.25, $2,422.43; C. O'Donnell, $1,243.22, $1,567.10, $2,810.32; O. W. De Groodt, $1,412.75, $1,301, $2,713.75; John G. Vetter, Jr., $1,780.07, $1,560.08 $3,340.15; Frank F. Beiler, $1,836.58, $1,676.13, $3,512.71; Smith & Thorn (Section 2), $2,077.10. For grading, the highest bid was 32½ cts. per cu. yd., lowest, 18 cts.; gutters, 6 ft. wide, highest 30 cts. per lin. ft., lowest 6 cts.

Sewers.—At Portland, Ore., contracts have been awarded to the Oregon Artificial Stone Co. for $575.14, $699.20 and $377.20.——At Thompsonville, Conn., the selectmen are having surveys made for the new sewers.——At St. Paul, Minn., a sewer contract has been awarded to Hans Hanson for $900.——Amsterdam, N. Y. The sewer work will be expensive as most of it will be through rock, 16 miles will be built as soon as possible. WM. B. LANDRETH is Constructing Engineer.

Street Railway.—At the sale of the Brenham Street Railway, Brenham, Tex., the property was sold to WM. A. WOOD, of Brenham, at the following prices: Track, material and 3 cars, $3,000; 18 mules, $600; franchise, books and papers, and sheds, $450; total, $4,050. The only other bidder was T. O. VOGLE, of Fort Worth, who bid $2,700 for the track and cars. Mr. WOOD bid the road in for the old company, which may be reorganized; otherwise the material will be closed out in lots and removed.

Water Pipe.—The following proposals were opened May 9 by the Water Commissioners, Schenectady, N. Y.: Florence Iron Works; 8-in. pipe, $35 per ton; 6-in., $35.50; 4-in., $36; specials, 3 cts. per pound. M. J. Drummond, New York: $35.75, $35.75, $37, 3 cts. John J. Fisher, Allentown, Pa.: $36.40, $36.40, $36.90, 2½ cts. Jackson & Woodin Manufacturing Co., Berwick, Pa.: $37.25, $38.25, $40.25. M. O. CALDWELL is Superintendent of Water-Works.

Steam Fire Engine.—The following proposals were opened May 10 by the Fire Commissioners, Baltimore, Md., for a steam fire engine of 500 galls. capacity, with all the latest improvements, and not weighing over 6,000 pounds; the old engine to be taken in part payment: Button Manufacturing Co., Waterford, N. Y., $2,700; Silsby Co., Seneca Falls, N. Y., $2,900; La France Co., Elmira, N. Y., $3,000; Clapp & Jones, Hudson, N. Y., $3,400; Manchester Co., Manchester, N. H., $3,800. The old engine in addition to these prices. The contract was awarded to the Silsby Co.

Street Crossings.—The following proposals were opened May 6 by the Highway Commissioners, Harrisburg, Pa.: B. Gastock, crossings 5 ft. wide, Morristown asphalt block, $3.59 per lin. yd.; West Virginia fire brick, $3.33 per lin. yd. James Nalen, asphalt block, $3.84 per sq. yd.; hard flint stone, $4.49 per sq. yd. Jacob F. Schleyer, asphalt block, 4 ft. wide, $1.29 per lin. ft.; 6 ft. wide, $1.69 per lin. ft. Henry Opperman, Jr., asphalt block, $3.65 per sq. yd.; hard Buffalo stone, 4 ft. wide, $1.47 per lin. ft.; 6 ft. wide, $1.93 per lin. ft. J. S. Sible, asphalt block, 4 ft. wide, $1.24½ per lin. ft.; 6 ft. wide, $1.86¾; Steubenville or Wheeling fire brick, 4 ft. wide, 91½ cts. per lin. ft.; 6 ft. wide, $1.36¾. These bids included all material, labor, etc. Contracts will be awarded about May 27.

Pipe and Castings.—The following proposals were opened May 6 by the Executive Board, Rochester, N. Y.: Donaldson Iron Co., Emaus, Pa.; 4 in. cast-iron water pipe, $34 per ton; 6, 8, 10 and 12-in., $31; special castings, 2½ cts. per pound; total, $2,790. Mellert Foundry & Machine Co., Reading, Pa.: 4 and 6-in., $33; 8-in., $32.75; 10 and 12-in., $32.50; 2¾ cts.; $2,933.25. Jackson & Woodin Manufacturing Co., Berwick, Pa.; 4-in., $35.50; 6-in. $33. 5; 8, 10 and 12-in., $33.25; 3 cts.; $3,012. Florence Iron Works, Philadelphia, Pa.; 4-in., $36; 6 and 8-in. $35; 10 and 12-in., $34; 3 cts.; $3,084. Buffalo Cast Iron Pipe Co., Buffalo, N. Y.; all pipe, $35; 3 cts.; $3,090. McNeal Pipe & Foundry Co., Burlington, N. J.; 4-in., $37; 6-in., $35.60; 8 and 10-in., $34.75; 12 in., $34.25; 3½ cts.; $3,135.65. Sayre Pipe Foundry Co., Sayre, Pa.; 4 and 6-in., $34; 8 and 10-in., $31.80; 3 cts. John J. Fisher, Allentown, Pa.; 4-in., $32.95; 6-in., $32.48; specials, 2½ cts. The contract was awarded to the Donaldson Iron Co.

Railroad Buildings.—The Chicago, Milwaukee & St. Paul R. R. Co. will erect a depot at Kansas City, Mo., at a cost of $150,000——The contract for the Union Depot at Portland, Me., has been awarded to James Cunningham, of Portland.——The Pennsylvania R. R. Co. will erect a fine passenger depot at New Albany, Ind.——The Vicksburg & Meridian R. R. Co. and Mississippi Valley R. R. Co. will each erect a passenger depot at Jackson, Miss.——The Boston & Lowell R. R. Co. proposes to enlarge its depot at Boston, taking in the present Eastern R. R. depot.——The Missouri Pacific R. R. Co. will erect car and machine shops at Atchison, Kan.——The Atchison, Topeka & Santa Fé R. R. Co. will build a new freight depot and make other improvements at La Junta, Col.——The Pittsburg & Lake Erie R. R. Co. will erect a 25 stall round house and car and repair shops at Chartiers, O.——The Missouri Pacific R. R. Co. will erect a fine office building at St. Louis, Mo., at a cost of $500,000.

Street Work.—At Albany, N. Y., the following proposals have been received by the Street Commissioner for flagging and curbing sidewalk: Thomas Reilly, Albany, $1.70 per ft.; Jacob Holler, Albany, $2.19. Contract awarded to Thomas Reilly.——At Utica, N. Y., a contract has been let to Fowler & Baxter for granite block paving at $3.61 or $3.69 per sq. yd., according to plan adopted; curbing, 65 cts. per ft., gutter, 35 cts.; crosswalks, 40 cts. per sq. ft.; catch basins, $99.50 and $116 each; manholes, $60 each. James Howlin has a contract for 2 catch basins at $72 each.——At St. Paul, Minn., contracts for grading have been awarded as follows: Palmer & Dunkler, $64,120; V. B. Parks, $12,471; Henry Justus, $26,400; G. Gerlich, $11,400.——At New Orleans, La., the contract for cobble stone paving on Locust street has been awarded to Dennis Corcoran at $3 75 per yd.; curb stones and gutter stones, 85 cts. per lin. ft.——At Pittsburg, Pa., contracts have been awarded as follows: grading, M. Gallagher; Neuchatel asphalte paving, Peabody & Long; street crossings, Bunte, Kaiser & Co., 83 cts. per sq. ft.; repairing vulcanite pavement, Peabody & Long, $2.25 per sq. yd.; gutter and sewer castings, Fisher Foundry & Machine Co., $1.78 per 100 pounds.——At Vincennes, Ind., the following proposals have been received for street improvement: C. T. Raker, embankment 10 cts. per cu. yd.; excavation, 15 cts., gravel 37 cts.; Wm. Neimann, 12½ 16¼ and 40 cts. Contract awarded to C. F. Raker.

Bridges, Canals, Etc.

Bridge Notes.—(*New Hampshire*). Manchester. A granite arch bridge is to be built across the Piscatoquog river at South Main street. Address the Committee on Streets.——(*Massachusetts*). Lawrence. The bridge connecting North and South Lawrence was burned May 4, the fire being caused by the electric light wires. The bridge had been condemned as unsafe. It is proposed to raise $75,000 for a new bridge and meanwhile a temporary structure is to be erected at a cost not to exceed $2,000.——The Boston & Maine R. R. Co. is having all its bridges tested.——(*New York*). Poughkeepsie. The caisson for pier 5 of the Poughkeepsie bridge was towed into place May 7.——(*Ohio*). Steubenville. The Pennsylvania R. R. Co. is erecting a large steel bridge over the Ohio river.——(*Indiana*). New Albany. The steel bridge across Silver creek, for the New Albany & Eastern R. R., will have three 80 ft. spans.——(*Virginia*). Richmond. The Metropolitan Quick Transit Bridge Co., recently incorporated by T. C. WILLIAMS and others, will build a bridge across the James river three miles above the city.——(*Minnesota*). St. Paul. The city has ordered the railroad companies to build bridges over certain streets crossed by the tracks. The Chicago, Milwaukee & St. Paul R. R. Co. will obtain legal opinion as to whether the city can compel it to build the bridges over Prior and Snelling avenues; it will build a $40,000 bridge to carry Marshall avenue over the tracks.——(*Wisconsin*). Eau Claire. The new bridge across the Chippewa at Shawtown has been completed; it cost $7,000.——(*Canada*). Smith's Falls, Ont. A double swing bridge is to be built across the Rideau; $12,000 has been appropriated for this purpose.

Fairport Harbor.—Considerable improvements are being made to the harbor at Fairport, O. The piers are being extended into deep water, and piling and dredging is being carried out rapidly.

Railroads.

Grading and Tracklaying.—*East of Chicago.*—Washington & Potomac R. R. Work is in progress on the extension of this line in southern Maryland between California and St. Mary's City.——Vincennes & New Albany Ry. Co. A reorganization has been effected and construction will begin at once. The line from New Albany to Jasper will be finished this year.——Grand Trunk Ry. It is reported that the work of double tracking the main line will begin this season.——Fitchburg R. R. This company which now owns the Troy & Boston and Boston, Hoosac Tunnel & Western lines, will lay three miles of track from Reynolds to Schaghticoke and have thus a short line to Saratoga Springs.——Ohio & Northwestern Ry. Work is progressing on the line between Gallipolis and Portsmouth, Ohio, and extensive improvements are in progress on the old Cincinnati & Eastern line. Material has been purchased for the extension of the Columbus & Maysville line.——The Dayton & Toledo Narrow Gauge Ry. is being altered to standard.

Southern.—Georgia, Midland & Gulf R.R. Grading on this line will be finished by June 5.——Norfolk & Western R. R. At the recent annual meeting the extension policy of the management was endorsed, and the contracts already made for the construction of the Clinch Valley line to a connection with the Louisville & Nashville's Cumberland Valley extension near Big Stone Gap, were ratified.——Orlando & Winter Park Ry. Hon. J. R. MIZELL, who is interested in this line, says that grading is being pushed and that there is strong probability of the line being extended north to Lake Jessup.——Mobile & Dauphin Island. This line which has been surveyed from Mobile to Dauphin Island at the mouth of Mobile Bay, 36 miles, will be constructed at once, and is really a scheme of much importance, both to Mobile and the rapidly growing section of the south whose seaport this city naturally is. At the southern terminus docks will be built at which ships of any draft can lie and transfer their lading directly to or from the car. It would seem that Dauphin Island and the shore adjacent would be a promising locality for a real estate boom.——Georgia Southern & Florida R. R. A construction company has been formed to build the line, and work will be begun at Tifton, Ga., as soon as contracts can be let.——Louisville Southern R. R. This line, from Louisville to Danville, Ky., is being actively pushed. Portions of the line will be ready for the rails by July 1. JOHN MACLEOD is Chief Engineer.

The Northwest.—Chicago, Danville & St. Louis R. R. The line between Danville and Tuscola, Ill., is nearly graded. From Tuscola the line will run to Sullivan and from that point the route has not been determined. The citizens of Shelbyville are anxious to have the road go by their city, and to ensure it, have organized a company to build a line from Shelbyville to Sullivan. St. Paul, Minneapolis & Manitoba Ry. It is said that 2,500 teams and 500 men are at work on the Great Falls extension.

The Southwest.—Leavenworth & Olathe R. R. The road will open for business May 22.—Fort Worth & Rio Grande R. R. 27 miles of track are laid and it is expected to reach Granbury, 40 miles from Fort Worth, by June 1.——Arkansas & Louisiana R. R. The contract has been let for 20 miles of road between Gibsland and Homer, La.——Missouri Pacific. On the Taylor, Bastrop & Houston line, the bridge at Bastrop is finished and track is being laid toward La Grange at the rate of a mile a day. On the Denver, Memphis & Atlantic division, the track has reached Winfield, Kan., from the West, and the junction with the force working from the East will be made by June 1.——Central Missouri. Grading has begun on this line at St. Charles, Mo.

Rocky Mountain and Pacific.—Southern Pacific Ry. The line from Newhall to San Buenaventura, Cal., has been opened for business.——Atchison, Topeka & Santa Fé Ry. Track between Santa Ana and Arlington on the California Central is being laid at the rate of a mile a day. The rails have been purchased for the line from San Diego to Coronada Beach. On the Denver & Santa Fé line, track is being laid from Colorado Springs.——Construction has begun on the branch of the Mexican National to Guadalajara.——Portland & Willamette Valley Ry. The six miles of this line between Elk Rock and Portland, Ore., still unfinished, will be completed at once.

Surveys.—*East of Chicago.*—Most of the right of way has been secured for the Attica, Anderson & Western Ry. in Indiana.——The Delaware & Otsego R. R. Co., the survey of which was noticed last week, has been duly incorporated, and proposes early construction.——Canastota, Morrisville & Southern Ry. The engineers have run three preliminary lines for this New York railway. It is now proposed to extend it to Stamford, to connect with the Delaware & Ulster R. R.——Detroit, Lansing & Northern R. R. Location is reported complete on the extension to Grand Rapids, Mich., and the right of way is mostly secured. The contract for the line will be let at once.

Southern.—Memphis & Charleston R. R. The extension from Chattanooga, Tenn., to Stevenson, Ala., has been located, and construction will begin immediately——Atlantic Coast Line. A preliminary survey has been ordered for a branch of the Cheraw & Darlington line from Cheraw to Chesterfield, S. C.——Columbus Southern R. R. The location of this line has been completed from Columbus to Albany, Ga., 87 miles. The amounts asked from the counties through which the line runs, are nearly raised, and its construction is considered certain.——Tennessee Midland Ry. The surveying party are working near Nashville, and right of way is being secured.

The Northwest.—Northern Pacific R. R. For some time a Winnipeg connection has been alternately rumored and denied, but now it is stated that its construction is decided. The line from Grand Forks Dakota, to the boundary, is under a locating survey, and construction will begin this season. The connection at the boundary will be with the Manitoba Central Ry., whose president, Mr. DUNCAN MCARTHUR, is reported to have said that the surveys from Winnipeg are completed and construction contracts signed, and that the whole 140 miles will be in operation in time to carry off this year's wheat crop. While the above should be taken with a few grains of allowance, the probabilities of the new line being built within a reasonable time are certainly good. It is stated that the proposed line from La Moure to Bismarck is under survey, and will be built this season.——Chicago, Kansas & Nebraska Ry. A St. Louis paper is responsible for the statement that a line is to be built by this company from Gilead, Neb., to Hastings; and that "in order to prevent any knowledge of the intentions of the company regarding the line, the entire survey was made by moonlight."——Springfield & Southern Ry. The directors are to hold a meeting soon and make arrangements for the survey. W. H. CURTIN, Nashville, Ill., is interested.

The Southwest.—Parsons, Girard & Acadia Ry. Parsons, Kan., has voted $30,000 bonds in aid of this line.——Texas Air Line R. R. The preliminary line between Galveston and Paris has been run *via* Canton, Emory, and Sulphur Springs.——Missouri & Central Kansas Ry. This line, the Chicago & Alton's new branch, now under survey from Odessa, Mo., has recently been voted aid by the towns of Burlington, Hampden, Star, and Winfield.——Missouri Pacific Ry. The party who recently completed the survey of the Mississippi river line to Cape Girardeau, Mo., are now locating a line from Bushburg on the St. Louis, Iron Mountain & Southern to a point opposite Chester, Ill.——St. Louis & San Francisco Ry. On the extension from Chadwick, Mo., the line is located to White river.——Chicago, Rock Island, & Pacific. The Denver line has been located *via* Belleville and Mankato, Kan., and the work is proceeding *via* Smith Centre, Phillipsburgh, and Norton. A line from Belleville to Clay Center is under survey.——Kansas City & Olathe. This proposed dummy line is under location.

Rocky Mountain and Pacific.—Southern Pacific Ry. The survey for proposed double track line from Oakland, Cal., to Martinez, has been finished. The party who have been locating the California & Oregon line through the Siskiyous are to make a reconnoisance for a line from Edgewood into Eastern Oregon. A survey will also be made for a line from Bradley on the Northern Division to Jolon.——Denver & Laramie City Ry. This new company has been incorporated in Wyoming and has also the benefit of the franchise of the old Denver, Yellowstone & Pacific Ry. It is said that engineers of a rival line would have shut the company out of the Virginia Dale Pass had not the old franchise given it a prior right. An effort is being made to unite the Northern Colorado Ry. Co., recently organized at Greely, with the Denver & Laramie Co. The line is under survey from both termini.

New Companies and Projects.—*East of Chicago.*—The construction of the International Ry. from Megantic, P. Q. to Mattawamkeag, on the Maine Central Ry., is the cause of many railroad schemes in Northern Maine. One proposed route for a through line from Portland to Quebec, is *via* the Farmington branch of the Maine Central, thence over the Franklin & Megantic, whose present diminutive gauge of 2 ft. would be widened to standard. From the terminus at Kingfield a new line would be built 50 miles in length to a favorable point on the International Ry.——Cincinnati & Southern Ohio R. R. Co. Incorporated to build from Rising Sun to Lawrenceburg, Ind. Col. HORACE SCOTT is President, and the C. I. St. L. & C. Co. is behind the enterprise.——A visit of Pennsylvania R. R. officials to Scranton, Pa., is construed to mean an extension to that point from Wilkesbarre, and various other branches in the anthracite regions.——A narrow gauge line is proposed from New Berlin to Bridgewater, N. Y., along the Unadilla Valley.——Terre Haute & Mississippi Ry. Co. Incorporated at Terre Haute, Ind., to build a railway to Hutsonville, Ill., to connect with the Ohio & Mississippi Ry.——Conneaut, Jamestown & Southwestern Ry. Co. Articles of incorporation have been filed in Ohio.——Newspaper rumor is locating a branch of the Fitchburg R. R. from North Adams to Pittsfield, Mass.——The Erie, Butler & Pittsburg R. R. Co. has been incorporated in Pennsylvania. F. W HUIDEKOPER is President.

Southern.—Northeastern R. R. of Georgia. Under the contract made with the city of Athens, Ga., by the Richmond & Danville R. R. Co., when they purchased the city's interest in the line, an extension of 15 miles was to be completed by April 15, 1886. The company now proposes to turn over the 21 miles of road from Rabun Gap to Tallulah Falls to W. B. THOMAS and associates, who promise to build an extension to Knoxville, Tenn., on condition that the city release the company from its liability for not building the extension as agreed. The city has accepted the proposal, taking a lien upon the portion of the line already completed as security.

The Northwest.—The city of Fremont, Neb., is to have a belt line railway about five miles in length.——The Forest City & Watertown Ry. is an old Dakota project, which has been resuscitated and is now proposed to Bowdle, Dak., 56 miles.——Winona & Southwestern Ry. The towns along the proposed line have been very enthusiastic in furthering the project, and a sufficient amount has been subscribed to ensure the building of the line.——The St. Louis & Dakota Ry. was a line chartered many years ago to build an air line from Sioux City, Dak., to St. Louis. There is some talk but little probability, of the project being taken up anew.

The Southwest.—Texas Trunk Ry. W. T. MOWRY, General Manager, has made a proposition to the citizens of Jacksonville, Tex., for an extension to that place from its present terminus at Cedar.——Kansas City, Independence & Lee's Summit Ry. Co. Incorporated at Kansas City, Mo., to build a railway to Lee's Summit, 23 miles. The right of way has been secured and surveys have begun. J. W. MERCER is President, and WM. B. KNIGHT, Chief Engineer.——Lawrence, Emporia, & Southwestern Ry. Co. A charter has been filed and a line is proposed from Lawrence to Winfield, Kan.——Dallas & Oak Cliff Ry. Co. Incorporated at Dallas, Tex., to build a line to Fort Worth. LEON BLUM, is interested.——Huntsville & New Orleans R. R. The line between Huntsville and Bryan, Tex., 55 miles, will probably be built this season.

Rocky Mountain and Pacific.—Denver & Rio Grande R. R. The extension to Albuquerque, N. M., was considered at the recent annual meeting. Two routes are proposed, from Santa Fé and from Espanola; the latter is said to be the easier route. The company proposes to build a cut-off in Colorado from Acequia to Salida or Buena Vista; and has ordered the construction of the line from Glenwood Springs to Aspen.——Two projected lines are reported in Mexico. One from Oaxaca to Huatulco, and the other in the State of Chiapa.——Missouri Pacific Ry. The Colorado extension has been incorporated as the Pueblo & State Line Ry. Co.